

CONCEPT DESIGN STUDY
FOR
INFANTRY REMOTE TARGET SYSTEM
MODIFIED AUTOMATED
RECORD FIRE RANGE
PN189 - FY89
FORT DEVENS, MASSACHUSETTS

Prepared by
US ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASSACHUSETTS

JULY 28, 1986

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INTRODUCTION

The Department of the Army, New England Division, Corps of Engineers, is providing Architect-Engineer services for the design of a Modified Automated Record Fire Range at Fort Devens, Massachusetts.

The Range is located within the limits of South Post Training area approximately 2 miles south of the cantonment area. The range is situated on existing ranges G and G-A and the Engineer Demonstration Area. Access to the range is via Jackson Road.

Work to be performed under the basic agreement shall include the following:

Design Services

1. Phase I: Concept Design (35%)

- a. Field investigation and coordination
- b. Preparation of concept drawings
- c. Preparation of a design report containing outline specifications, design analysis and cost estimate

2. Phase II: Final Design

This report completes the requirements of Phase I: Concept Design as defined in the basic agreement.

CHAPTER 1

GENERAL

1.1 DIRECTIVE AUTHORIZATION

Project Number - 189

Authorization - 28 June 1985

Category Code Number - 17902

Nomenclature - Modified Automated Record Fire Range

Directive Scope - See Paragraph 1.4 and Appendix 5

Program Amount - \$890,000

Cost Limitations - MMCA Limit

Fort Devens has been designated to receive the Modified Automated Record Fire Range (MARF). This range will be designed to meet the specific needs of the Remote Infantry Targeting System (RETS) equipment. Support structures to be furnished include control tower, latrine, ammo breakdown building, range control building, bleacher enclosure and covered mess facility. Criteria contained in DOD Manual 4270.1-M will be followed.

1.2 APPLICABLE SCOPE CRITERIA

Design will be accomplished in accordance with the definition and criteria contained in the document "Concept Submission Instructions" dated December 1979 and the following instructions: Construct a permanent, standard-design Modified Record Fire rifle marksmanship range consisting of 16 lanes and range support facilities. Facility to be designed using guidance contained in HNDM 1110-1-5 and TC-25-2. Range support facilities will include a control tower, latrine (male/female), range personnel/storage/maintenance building, covered mess, ammo breakdown building, covered bleacher, general maintenance area, and parking area. The Lyster bag holder was deleted at the request of Fort Devens range personnel.

Site development aspects of the range requires site specific analysis and evaluation, such as land surveys and foundation investigation, to insure maximum realization with minimal site disturbance. The terrain is to remain as natural as possible while incorporating the functional characteristics of the range.

1.3 PURPOSE AND FUNCTION

The purpose of this project is to modernize and update the target systems utilized in the training of individuals and units. It will allow for various simulated combat conditions and situations. This system will be a training device and teach individuals and leaders the technique of shifting, tracking and adjusting fire on targets.

This project is required to construct new training facilities in support of the Army Force Modernization Program which includes fielding of the RETS target systems at Fort Devens, Massachusetts.

The construction of the range is required at Fort Devens in FY 1989.

The proposed range is to be located at existing Range Nos. G and G-A and the Engineer Demonstration Area and oriented so as to utilize the existing impact area.

This project meets the requirement as set forth in AR 415-15. Accomplishment of this project will satisfy the construction requirement for site work. Installation of the RETS equipment will be accomplished separately.

1.4 DESIGN SCOPE

The New England Division is to perform Architect-Engineer services for the design of a Modified Automated Record Fire Range at Fort Devens, Massachusetts. The design of the proposed work to be accomplished in accordance with furnished directives dated 28 June 1985, as modified by the Design Guide for Infantry Rifle Marksmanship Ranges dated October 1985. Work will be as indicated in paragraph 1.2 APPLICABLE SCOPE CRITERIA.

Building computations are as follows:

<u>Building Unit</u>	<u>Area Square Feet</u>	<u>Occupancy</u>
Control Tower	230	2
Personal/Storage	800	2
Latrine	192	6
Ammo Breakdown	120	1

1.5 SITE VISIT NOTES

See Appendix 3.

1.6 GOVERNMENT-FURNISHED EQUIPMENT

The following equipment is to be furnished by the Government:

- a. RETS equipment - installed by manufacturer
- b. Public address equipment

1.7 CONSTRUCTION PHASING

The proposed new range will be constructed on the existing "Known Distance" (KD) ranges G and G-A, and on the existing Engineer Demonstration Area (EDA). The KD ranges are active ranges and will be closed down upon start of construction. The Directorate of Training and Security at the Post will have to temporarily transfer function of these ranges to other ranges on post or eliminate the "KD" training during the period of construction. The operation of the EDA will be limited to the southern or downrange portion of the area once construction is begun. Upon activation of the range, the EDA will have to be relocated to another area outside of the range limits.

The Contracting Officer shall direct the salvage of existing equipment.

1.8 CONSTRUCTION SEQUENCING

Construction sequencing will be required for efficient completion of the project. A preliminary outline of the various sequences are as follows:

- A. Construct Range (Modified Automated Record Fire Range)
 - 1. Install soil erosion and sediment structures. (If required).
 - 2. Remove existing structures from range and support area.
 - 3. Remove existing safety berms.
 - 4. Clear, grub and fill service roads, structure pads, paths, target pads, and firing line and safety berms. Construct drainage facilities.
 - 5. Construct service and access roads (gravel).
 - 6. Construct support structures, target coffins, and foxholes.
 - 7. Extend power supply from off-site location.

8. Install underground electrical to range and support facilities.
9. Selective clearing of firing lanes.
10. Install flag pole, lane markers, and miscellaneous signs and hardware.
11. Final landscaping and soil stabilization.
12. Remove temporary soil erosion control structures, if necessary.
13. Acceptance of completed range.

1.9 WASTE AND BORROW AREAS AND HAUL ROUTES

Haul routes, for use by the contractor, will be designated during the final design phase. Borrow areas will be required to construct the facility. During final design, a determination will be made as to whether on-post or off-post sites will be used.

1.10 AIR AND WATER POLLUTION CONTROL

No air or water pollution is anticipated. The following soil erosion procedures may be required.

1. Installation of sediment control barriers at strategic location on site (i.e., filter fence, straw bales, diversion berm, etc.), if necessary.
2. Appropriate soil stabilization measures as dictated by the site and construction phasing.
3. Compliance with Federal EPA and State erosion and sediment control requirements and standards.

1.11 SPECIFIC DESIGN PROBLEMS

No specific design problems were encountered.

1.12 INADEQUATE FUNDS

The project cost for the proposed range is \$1,725,000 which is \$835,000 above the programmed amount. Chapter 10 - ESTIMATE contains a detailed breakdown and explanation of the construction cost estimate.

1.13 WAIVERS

A waiver for operation of the range will be required. The extreme downrange left corner of the range safety fan falls outside of the post boundaries.

1.14 SECURITY PROVISIONS

The control tower will have an intrusion detection system installed. This system will be tied into the Range Control office located about 4700 feet away at the entrance to the South Post Training Area.

1.15 SUBMISSIONS

Seventeen (17) copies of this report and seventeen (17) sets of the attached conceptual design drawings have been provided. Report and drawings are of standard size.

1.16 OTHER SPECIAL PROVISION ITEMS

- a. Occupancy and use of the existing "KD" Range will be restricted during construction of the proposed project.
- b. No special permits are required to be obtained by the contractor.
- c. Open burning of debris is not allowed.
- d. Government utilities are not available.
- e. No use of government equipment during construction is anticipated.
- f. Blasting and storage of explosives is not required for the project.
- g. Construction of the project will not be affected by utility outages.
- h. The expected length of project is 24 months.

1.17 ENVIRONMENTAL PERMITS

None required.

1.18 HANDICAPPED REQUIREMENTS

In accordance with PL 90-480, no provisions for the handicapped will be made in the project since, in the foreseeable future, the facility will be used and operated solely by able-bodied personnel.

1.19 SOLAR STUDY

Not applicable.

1.20 ENERGY AUDIT

A. None required.

B. Energy Sources

1. Heating: Oil-fired hot-air furnace heating instruction building (std. bldg. 2) and heat pump with supplementary electric heat for control tower. All other buildings are unheated.
2. By electric unit NED
3. By others (electric unit NED)
4. Energy Conservation: Adequate insulation will be added to heated buildings to conserve energy.
5. Energy Alternatives: N/A
6. Energy Effects: N/A
7. Basis for Appraisal: In consideration of energy sources and energy requirements, solar energy and selective energy sources have been excluded as inapplicable.

1.21 ECONOMIC ANALYSIS

Not applicable to project.

1.22 ECIP ANALYSIS

Not applicable.

1.23 FUNCTIONAL CRITERIA

No changes have been made by user.

1.24 REHABILITATION

Not applicable to project.

CHAPTER 2

SITING

2.1 NARRATIVE DESCRIPTION

A. General

1. Existing ranges G and G-A are active ranges used for "Known Distance" (KD) weapons training. Live firing is done from a series of elevated firing berms located at various distances from the target line. The targets are the large manually operated 'bullseye' type.
2. The Engineer Demonstration Area (EDA) is located immediately west of ranges G and G-A. It is a relatively level area where engineer troops practice and demonstrate earth moving techniques and equipment.

B. Existing Site Conditions, ranges G and G-A.

1. Ranges G and G-A lie adjacent to each other with G range being sited to the west of G-A. The ranges are oriented approximately north to south with the target line located at the southern end. A small, 7 to 8 foot high, safety berm separates the two ranges.

Another safety berm of approximately the same height along the westerly edge of Range G separates that range from Jackson Road, a paved access road leading to other training facilities. Range G is approximately 155 meters wide and 555 meters from the target line to the farthest raised firing berm. Range G-A is 68 meters wide and 335 meters long. Very little vegetation exists on the ranges. There is some grass and wild shrubs growing but about 50% of the area is void of any cover. In these areas the humus or topsoil is also gone exposing the subsurface soils. Bordering the left or easterly side of Range G-A is a heavy stand of trees and undergrowth comprised of deciduous and pine trees and brush. The ranges are accessed directly off of either Jackson Road or Dixie Road, which runs along the northern and easterly edge of the ranges. Two service roads, one on the easterly side of G-A range and one on the westerly side of G range provide access to the downrange area and the target pit. A road connects these service roads at the northerly end of the ranges. An access road to the target pit is also provided off of Jackson Road at the downrange end of the KD range.

The terrain is relatively level throughout both ranges. The relief in topography is primarily due to the safety berms and the raised firing positions. Elevations throughout the ranges, exclusive of the safety berms range from 260 ft. NGVD to about 264 ft. NGVD. The safety berms have a top elevation of about 270 ft. NGVD.

2. The existing firing positions consist of raised berms, approximately three feet above surrounding terrain, with numbered firing points corresponding with the downrange targets. There are no 'foxhole' type firing positions.
3. The existing support facilities for ranges G and G-A consist of: covered bleachers, covered mess facility, two flag poles, an ammo issue point and Lyster Bag holder at the northern end of the ranges and; at the downrange end, a target shed, latrine and the target pit with the target elevating mechanisms.

C. Existing Site Conditions, Engineer Demonstration Area (EDA).

1. The EDA is located to the west of Range G, directly across Jackson Road. This area is used for training of engineer troops. The area is approximately 190 meters wide and 580 meters long. There is very little vegetation growing on the site especially at the southern end which is used for training engineer troops in the use of earthmoving equipment and procedures. Bordering on the westerly side of the EDA is a heavy growth of trees, both deciduous and pine, and brush. A jeep trail parallels the wooded area along the westerly edge of the area.

The terrain is relatively level throughout the area. Elevations range from 260 ft. NGVD to 263 ft. NGVD. Towards the downrange end of the EDA there are numerous depressions and hillocks that are the result of past engineer training sessions. Along and parallel to the westerly edge of the EDA, at about the edge of the existing tree line, there is a series of small rises with elevations in excess of 265 NGVD. To the west of this the terrain drops off, falling to elevations below 240 NGVD. This area, with one exception, falls outside of the work limits of the new range. The exception exists at the northwest corner of the new range where the terrain drops off to elevations below 245 ft NGVD.

2. There is one latrine located at the extreme northern end of the EDA. In addition to the latrine there is a concrete helicopter pad located at the northern end of the EDA about 45 meters from Jackson Road.

2.2 SITE USE AND ADAPTATION

A. Site use criteria

1. The existing ranges G and G-A and the EDA were evaluated for conversion to a modified automated Record Fire Range using the following criteria:
 - a. Minimal disturbance of the natural cover and terrain.
 - b. Expansion of the area occupied by ranges G and G-A and the EDA to a width of 540 meters to allow for construction of the proposed range and lateral safety berms.
 - c. Minimal disturbance to the existing features of Range G, such as the raised firing berms, in order to allow for continued use of this KD range.
 - d. Placement of the target coffins at or slightly above existing grade to minimize drainage and maintenance problems.
 - e. Placement of the targets to accommodate the primary function and purpose of the range - to evaluate the individual soldiers ability to correctly engage multiple targets in a time constrained training environment.
 - f. Removal of existing range support facilities.

B. Site Adaptation

1. A review of the existing ranges and the EDA reveals that little in the way of existing features can be incorporated into the proposed range. Siting will be accomplished to minimize or limit disturbance of the existing vegetation and terrain.
2. Drainage throughout the area is primarily through ground recharge. Target emplacements will be located at or slightly above grade to facilitate drainage within the immediate area of each target.

3. The existing range support facilities for ranges G and G-A will be either removed or relocated. These include: two small flag poles, an ammo issue point, lyster bag holder, a covered mess area, and covered bleachers. These facilities will be reused by the post at other locations. At the EDA the latrine will be removed.
4. The existing concrete helicopter pad will remain and will become a part of the proposed range. An access road to the pad will be provided.
5. The portion of Jackson Road from the intersection with Dixie Road to the proposed firing line will remain in place and will be used to provide access to the proposed range. The existing safety gate at Jackson Road and Dixie Road will also remain in place.

C. Site Improvements

1. The new firing line will be on a raised berm (elev. 266 ft. NGVD) approximately 430 meters from the KD target line. Elevating the firing line is necessary to facilitate target acquisition and engaging, shifting and adjustment of fire on the targets.
2. Due to the depth of snowfall normally occurring in the Fort Devens region, and the desire to operate the range year round, the 'Alternative 2' target emplacement will be used. Because the target operating mechanism is elevated above grade this should facilitate operation even when there is snow cover. Also, problems associated with adverse drainage conditions would be lessened due to the elevated mechanisms. The target implacements will be set on a 12-inch layer of well drained gravel fill.
3. The range operations and control area contains the primary training and control components, consisting of the firing line, control tower, ammo breakdown building and a range control building. The control tower, ammo breakdown building and range control building will be located to the rear of and at the center of the firing line. The control tower will be about 15 meters behind the firing line and the floor will be set at elev. 282.33 ft. NGVD. This will allow for a view of all firing positions and the downrange area. The ammo-breakdown building will be located adjacent to the tower on a direct path from the parking/staging areas to the firing line. Slightly to the rear of these facilities will be the range control building. It will be used for range

operations and maintenance functions and will conform to Standard Building No. 2 as shown on STND DRWG A-5. These facilities will be accessed from Jackson Road by a two lane paved road. A single lane gravel road will connect this area with the training area located about 82 meters to the rear of the firing line.

4. The training area will consist of a covered mess area, covered bleachers, a staging/parking area and a combination male/female latrine. The mess area, bleachers and staging/parking area will be located together approximately opposite the mid-point of the range. Access to this area from Jackson Road will be by a single lane gravel road. There will also be a single lane gravel road connecting this area to the range operations area and the firing line. Approximately 50 meters downwind of the mess area and bleachers will be the combination latrine. Access to the latrine will be by a single lane gravel road to allow for servicing and maintenance.
5. Two main service roads will run downrange, one on each side of the proposed range. The service road on the right, or westerly side, of the range will be connected to the range operations area via a road running behind the firing line. The left service road will intersect with Dixie Road and will run downrange past the most extreme downrange limits of the proposed range. This road will continue on following the alignment of an existing jeep trail to the KD range target pit. This extension of the service road will be used to provide access to the target pit and to the downrange firing berms of the KD range. In addition three connecting service roads will cross the proposed range at 55, 185 and 275 meters downrange to provide access for maintenance and servicing the target mechanisms and to access other KD range firing berms.
6. Two lateral safety berms will be constructed one each along the easterly and westerly edges of the proposed range. These berms will be outside of the limits of the downrange service roads. Each berm will have a top elevation of 272 ft. NGVD. Both berms will begin 10 feet to the rear of the firing line. The left, or easterly, berm will run downrange for approximately 425 meters while the westerly berm will run downrange for about 455 meters. The berms are required to provide protection for the existing firing ranges located along Trainfire Road, downrange and east of the proposed range, and for the proposed Squad Automatic Weapons (SAW) Range to be located to the west of this range.

7. Other new items to be constructed for this range include: a new flag pole located in the vicinity of the intersection of Jackson Road and Dixie Road, a new range sign and an access road and parking area connecting the helicopter pad with Jackson Road. In addition, a safety gate will be located on the left service road just before the firing line to prevent accidental or unauthorized access downrange during periods when the range is active.

2.3 DESIGN CRITERIA

A. Design criteria for this range is contained in from the following publications and sources:

1. HNDM 1110-1-5, Design Information for Infantry Rifle Marksmanship Ranges
2. FM 25-7, Training Ranges
3. AR 385.10, Army Safety Program

2.4 LOCATION MAP

See Sheet 1

2.5 SITE PLAN

See Sheet 2

2.6 GRADING PLAN

See Sheets 4 & 5

2.7 SITE UTILITY PLAN

See Sheets 4 & 5

2.8 CRITERIA REQUIRED FOR FINAL DESIGN

Current design directives call for placing power and data cables to the locations of all stationary and moving target emplacements and to the hostile fire simulators. However, it is understood that the moving target emplacements have been permanently dropped from the IRETS program. Verification of the deletion of the moving targets and emplacements is required before final design is started. Deletion of these items will eliminate the need to run power and data cables to these location.

CHAPTER 3

CIVIL

3.1 SERVICE ROADS, PATHS, STAGING AREAS AND PARKING AREAS

A. Soils

1. The characteristics of the foundation soils are unknown. Surficial evidence indicates a loose, uniformly graded, medium to fine SAND (Unified Soil Classification -SP). Portions of the area are overlain with a thin layer of humus or topsoil. Subsurface explorations will be conducted during subsequent phases of design.

B. Traffic

1. All new access and service roads will be classified as tertiary 'Class F' roads. The traffic is 'light' and the roads will be designed accordingly. The service roads will accommodate single lane traffic and will be used to provide access to downrange areas and for maintenance and servicing of the target mechanisms.
2. The access roads also will be single lane with the exception of Access Road No. 1 which will be double lane. The access roads will be used to provide access to the firing line and to the range operations area, for delivery of supplies and munitions and for servicing of the latrine.

C. Pavement

1. With the exception of Access Road No. 1 all roads will have a compacted gravel surface. The roads will have a travel width of 12 feet with 4 foot shoulders along each edge. All existing soil along the road alignment will be excavated to a depth of 12 inches. Compacted gravel base course material, minimum depth-18 inches thick, will bring the surface of the new roads a minimum of 6 inches above existing ground.
2. Access Road No. 1 will be paved with 3 inches of bituminous concrete. This road will have a paved width of 24 feet with 4 foot gravel shoulders. All existing soil will be excavated to a depth of 12 inches. New compacted gravel base course material will be placed to a depth of 18 inches.

D. Paths, Staging Areas and Parking Areas.

1. The path leading past the ammo-breakdown building to the firing line, and the parking lots adjacent to the ammo-breakdown building and the range control building will be paved with bituminous concrete pavement. The path will be constructed of 2 inches of pavement over a 12 inch compacted gravel base course. The parking areas will consist of 3 inches of pavement over an 18 inch compacted gravel base course. The parking areas will be graded to slope away from Access Road No. 1 at approximately 1/8 inch per foot.
2. The staging and parking area next to the covered mess and bleachers will have a compacted gravel surface. The construction will be similar to the service roads and Access Roads No. 2 and 3. The staging and parking area will be graded to slope away from Access Road No. 2 at approximately 1/4 inch per foot.

E. Design Criteria

T.M. 5-822-2, General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas.

T.M. 5-822-5 Flexible Pavement for Roads, Streets, Walks and Open Storage Access.

- F. See sheets 2, 4 & 5 for plan of the access and service roads and the staging and parking areas.

3.2 GRADING, STORM DRAINAGE

- A. Grading will be kept to the minimum necessary to construct the range. A portion of the existing safety berms will be removed to make way for the new range. The extent of removal is shown on sheet 4. Some additional grading is anticipated, especially in the Engineer Demonstration Area, to recontour the land and eliminate the 'pool table' effect.
- B. Surface runoff is not expected to be a major problem. Rainfall percolates readily into the soil and no natural flow paths or points of concentration of runoff appear within the area. At the northwest corner of the range one culvert will be installed where the service road crosses a fill area.

Within the range support area, all surface drainage will be handled by elevating all roads, parking and staging areas, and buildings above the existing ground and grading away from these features.

- C. A 10-year natural rainfall recurrence interval with an hourly rainfall of 1.8 inches will be used for design purposes.

3.3 FENCING

Fencing of the general site is not required.

3.4 RANGE TARGET COFFINS, FOXHOLES AND HOSTILE FIRE SIMULATOR COFFINS

- A. The target coffins, foxholes, and hostile fire simulator coffins will be of standard design and either cast-in-place reinforced concrete or pre-cast concrete. All concrete will be 3000 p.s.i. At each placement location the existing soil will be removed to a depth of 12 inches and replaced with compacted gravel fill. Above this fill will be placed the 6 inches of aggregate material required beneath each coffin or foxhole.

3.6 CRITERIA REQUIRED FOR FINAL DESIGN.

- A. The characteristics of the foundation soils are unknown. However, surficial evidence indicates that frost action will not be a problem. During subsequent design stages a program of subsurface exploration will be accomplished to determine soil characteristics and design parameters.

3.7 DESIGN GUIDE SPECIFICATIONS

<u>TITLE</u>	<u>NUMBER</u>
Select material subbase course	CE-02232
Graded-crushed-aggregate base course	CE-02233
Bituminous intermediate and surface courses for roads and open storage area (control plant hot-mix)	CE-02551
Storm drainage systems	CE-02430
Excavation, trenching, and backfilling for utility systems	CEGS-02221
Excavation, filling and backfilling for buildings	CEGS-02201
Formwork for concrete	CW-03101

Steel bars, welded wire fabric and accessories for concrete reinforcement	CW-03210
Cast-in-place structural concrete	CW-03701
Concrete for building construction	CEGS-03300
Concrete for building construction (minor requirements)	CEGS-03301

CHAPTER 4

UTILITIES

4.1 WATER SUPPLY

- A. There is no potable water supply in the area of the proposed ranges. Water will be supplied by the use of water trailers.

4.2 SANITARY SYSTEM

- A. There is no comprehensive sewage collection or treatment system in the area of the proposed site range. The ranges will be served by a latrine with a holding tank. Normal operation of the latrine is to pump from the latrine for sewage disposal at an approved site for treatment.

4.3 GAS LINES

- A. There are no known gas lines in the vicinity of the proposed ranges.

4.4 OTHER UTILITIES

- A. See CHAPTER 8 ELECTRICAL for Electrical and Telephone requirements.

4.5 CRITERIA REQUIRED TO COMPLETE FINAL DESIGN

- A. None

4.6 GUIDE SPECIFICATIONS

<u>TITLE</u>	<u>NUMBER</u>
Electrical Distribution System - Aerial	CEGS-16401
Electrical Distribution System - Underground	CEGS-16402

CHAPTER 5 ARCHITECTURE

5.1 GENERAL DESCRIPTION

A. Design Criteria

1. DOD-4270.1-M, December 15, 1983
2. 1391-Project Construction
DATA: Modified Automated
Record Fire Range
3. U.S. Army Corps of Engineers
Huntsville Division
Design Information for Infantry Rifle Marksmanship Ranges
HNDM-1110-1-5; October 85
4. User Data
5. N.F.P.A., 1982, Standard 101

5.2 TYPE OF CONSTRUCTION AND CATEGORY

BUILDING	CONSTRUCTION TYPE	USE CATEGORY
Control Tower	Semi-Permanent Non Combustible Unprotected	179 71
Range Control (Standard Building No. 2)	"	171 23
Latrine	"	171 24
Ammo-Breakdown Building	"	171 23
Bleachers Enclosure		
Covered Mess Area	"	171 23

5.3 DESIGN SOLUTION

- A. The general parameters and overall design constraints were established by the U.S. Army Corps of Engineers, Huntsville-Division, the Using Agency and Stanley Consultants, Inc. The IRETS document presents nonsite specific information. Any modification to alter specific data is documented herein.

The general building configuration, materials, dimensions, layout and construction requirements are presented in the infantry rifle marksmanship ranges design information.

B. Construction Systems are as follows:

1. CONTROL TOWER

ITEM	DESCRIPTION
a. Framing System	Steel
b. Floor System	Concrete slab over metal deck with insulation below.
c. Wall System	Insulated metal panel
d. Roof System	Insulated metal panel
e. Fenestration	Thermal Break-insulating glass sliding aluminum windows
f. Doors	Insulated hollow metal
g. Miscellaneous	Catwalk-galvanized steel grating

2. RANGE CONTROL (STANDARD BUILDING NO. 2)

a. Structural System	Structural steel pre-engineered building
b. Floor System	Concrete slab on grade
c. Wall System	Metal siding with 3-1/2" batt insulation
d. Roof System	Metal roof with 6" batt insulation
e. Fenestration	Double-hung aluminum window with insulating glass and steel mesh security screen
f. Doors	Insulated hollow metal

3. AMMO-BREAKDOWN BUILDING

a. Structural System	Steel pre-engineered building
b. Floor System	Concrete slab on grade
c. Wall System	Metal siding
d. Roof System	Metal roof
e. Fenestration	Hinged aluminum window with polycarbonate glazing. Storm-proof louvers
f. Doors	Hollow metal
g. Miscellaneous	Counter: plastic laminate

4. LATRINE

a. Structural System	Steel pre-engineered building
b. Floor System	Slab on grade
c. Wall System	Metal siding
d. Roof System	Metal roof
e. Fenestration	Aluminum double-hung with steel security screens
f. Doors	Hollow metal
g. Miscellaneous	Sanitary fixtures stainless steel

5. COVERED MESS

a. Structural System	Steel frame
b. Floor system	Slab on grade
c. Wall system	No wall
d. Roof System	Metal roof
e. Miscellaneous	Tables Galvanized steel

5.4 SECURITY PROVISIONS

Security provisions are provided by security screens, locking devices, omission of louvers in doors, and intrusion detectors.

5.5 CONCEPT:

Standard Drawings are used with minimal modification.

<u>DRAWING NO.</u>	<u>TITLE</u>
A-1	CONTROL TOWER ENCLOSURE-PLAN/ELEVATION
A-2	CONTROL TOWER ENCLOSURE SECTIONS/DETAILS
A-3	NOT USED
A-4	NOT USED
A-5	STANDARD BUILDING NO. 2 - PLAN AND ELEVATIONS
A-6	STANDARD BUILDING NO. 2 DETAILS
A-7	LATRINE
A-8	AMMO BREAKDOWN BUILDING
A-9	COVERED MESS-PLANS AND SECTIONS
A-10	NOT USED
A-11	BLEACHER ENCLOSURE Drawing Not Included, Missing From Standard Drawings Package Recieved From Huntsville

5.6 ARCHITECTURAL DESIGN CHANGE CONSIDERATIONS

A. General: Because of the northern location all buildings with slab on grade conditions have been provided foundations.

B. Range Control Bldg:

1. Door louvers were eliminated because of climate conditions and for security reasons.

C. Ammo Breakdown Building:

1. Insulation is deleted
2. The fold down metal panels were revised into fold down windows with polycarbonate glazing for security.

D. Latrine:

1. The building is divided into men and women, one extra water closet has been added to Men. Plan & Elevations have been revised accordingly.
2. Insulation is deleted

5.7 ADDITIONAL DOCUMENTS TO COMPLETE PROJECT

Guide Specifications as listed.

5.8 PRELIMINARY LIST OF ARCHITECTURAL SPECIFICATIONS

<u>TITLE</u>	<u>NUMBER</u>
Metal Buildings	CE-201.01
Masonry	CEGS-04200
Concrete (For building construction minor requirements)	CEGS-03301
Miscellaneous Metals	CEGS-05500
Metal Roofing and Siding, Plain	CE-222.01
Metal Roofing and Siding, Factory-Color Finished	CE-222.01
Steel Windows	CEGS-08510
Aluminum Windows	CEGS-08520
Sheet Metal Work, General	CEGS-07600
Steel Doors and Frames	CEGS-08110
Finish Carpentry	CE-235.04
Excavation, Filling and Backfilling for Buildings	CEGS-02201
Structural Steel	CEGS-05120

Roof Decking, Steel	CEGS-05301
Insulation for Built-Up Roofing	CEGS-07241
Caulking and Sealants	CEGS-07920
Hardware; Builders' (General Purpose)	CEGS-08710
Glass and Glazing	CEGS-08810

CHAPTER 6
STRUCTURAL

6.1 STRUCTURAL FRAMING SYSTEMS

- A. Framing systems are described in the Architectural Section, Chapter 5, Paragraph 5.4, and follow recommendations suggested in the Design Guide and Standard Working Drawings. The foundation systems have been site adapted for the Fort Devens area, in anticipation of a deeper frost penetration.

6.2 ROOF AND FLOOR SYSTEMS

See Architectural Section, Chapter 5, Paragraph 5.4.

6.3 WALLS AND PARTITIONS

See Architectural Section, Chapter 5, Paragraph 5.4

6.4 FOUNDATION SYSTEM

- A. Tower shall have tied spread reinforced concrete footings with piers.
- B. Buildings shall have continuous concrete footings under foundation walls.
- C. Allowable soil pressure shall not exceed 2000 lbs/square foot per Mass. Building Code (Loose Medium Sand)
- D. Maximum frost penetration in Fort Devens is 64 inches, per DRAFT TM 5-809-1, Appendix A. This value was reduced for foundation design to 48 inches in accordance with Appendix F.

6.5 FRAMING PLANS AND FLOOR THICKNESSES

See Architectural concept drawings.

6.6 DESIGN LOADS

- A. Floor live loads (Per Design Manual, dated June 1982).
Tower Walkway and stairs: 100 PSF
Tower Floor: 60 PSF
- B. Roof live load (snow), (per DRAFT TM 5-809-1).
 $P_f = 0.7 C_e \times C_t \times I \times P_g$
Pf-Flat roof design snow load
Ce=Exposure factor=1.0; Table G-1, Category C.

Ct-Thermal factor = 1.2; Table G-2, Assume unheated.
 I=Risk Factor=0.8; Table G-3, Low Risk.
 Pg-Ground snowload = 45 psf; TM 5-809-1
 $P_f = 0.7 \times 1.0 \times 1.2 \times 0.8 \times 45 = 30.24 \text{ PSF}$
 Total Roof Design Load = 30.24
 Say 31 PSF

NOTE: Design Manual Uses 40 PSF Live Load in Tower Design.

C. Wind Loads (per DRAFT TM 5-809-1)
 $W_p = \text{Design Wind Pressure} = q G_f C_p$
 $q = \text{Velocity Pressure} = .00256 K_z (IV)^2$
 $V = \text{Basic Wind speed} = 80 \text{ mph; Appendix A TM 5-809-1}$
 $I = \text{Importance Factor} = 1.00; \text{Table 5-1}$
 $K_z = \text{Velocity Pressure Exposure Coef.; Exposure C, Table 5-2}$
 = .98 (Tower)
 = .8 (Personnel/Storage, Latrine, Ammo Buildings, Covered
 Mess and Bleacher Enclosure)

$G_h = \text{Gust Response Factor; Exposure C, Table 5-3}$
 = 1.26 (Tower)
 = 1.32 (Personnel/Storage, Latrine, Ammo Buildings, Covered
 Mess and Bleacher Enclosure)

$C_p = \text{External Pressure Coef.; Fig. 5-2}$
 = .8 Windward Wall
 = .5 Leeward Wall

1. Personnel/Storage, Latrine, Ammo Buildings and Bleacher Enclosure

a. Windward Wall
 $W_p = 0.00256 (.8)(1.0 \times 80)^2(1.37)(.8)$
 $P = 14.37 \text{ PSF}$

 a. Leeward Wall
 $W_p = 0.00256 (.8)(1.0 \times 80)^2(1.37)(.5)$
 $P = 8.98 \text{ PSF (Min. Wind Load Recommended)}$

2. Control Tower

a. Windward Wall
 $W_p = 0.00256 (.98)(1.0 \times 80)^2(1.26)(.8)$
 $P = 16.18 \text{ PSF}$

 b. Leeward Wall
 $W_p = 0.00256 (.98)(1.0 \times 80)^2(1.26)(.5)$
 $P = 10.12 \text{ PSF}$

NOTE: Design Manual uses 30 PSF for tower design.

D. Seismic Loads (per TM5-809-10/AFM 88-3), Chapter 13, dated Feb. 1982) Zone 2, Z=0.5 (low-loss potential)

6.7 UNUSUAL DESIGN FEATURES:

None

6.8 CRITERIA NEEDED TO COMPLETE DESIGN:

None

6.9 GUIDE SPECIFICATIONS TO BE USED:

See Architectural Section, Chapter 5, Paragraph 5.9.

CHAPTER 7

MECHANICAL

7.1 HEATING VENTILATION AND AIR CONDITIONING

A. Basic Analysis

1. Basic Criteria Manuals: ASHRAE, DOD 4270.1-M

2. Design Considerations

a. Inside: Summer 80⁰F (Tower only)
Winter 68⁰F (Tower & Std.Bldg 2)

Outside: Summer 2.5% DB 89⁰F
5% WB 73⁰F
Winter 1⁰F

b. Personnel Load: 3 in control tower

c. "U" Factors:

	<u>Tower</u>	<u>Std bldg. 2</u>
Roofs	.10	.05
Walls	.10	.08
Glass	.55	.55
Doors	.59	.59
Floors	.11	-

d. N/A

e. Ventilation: no change to standard drawings

3. Type of Systems:

a. The range building (Std Bldg #2) will have a roof exhaust fan for summer ventilation. Heat will be supplied by an oil fired warm air furnace.

b. The control tower will have a heat pump with supplementary electric heater.

4. Temporary Outages would affect the user: N/A

B. Calculations:

The control tower heating load is 14,094 Btuh and the cooling load is 22,027 Btuh.

The range building (Std Bldg #2) heating load is 52,731 Btuh.

A detailed listing of design computations is included in Appendix 2.

C. Equipment:

1. The equipment is basically as stated above and listed on standard drawings.

2. For manufacturers upon whose equipment design is based see detailed design calculations at the end of this chapter.

D. Piping System: N/A

E. Air Distribution Systems: N/A

F. Listing of Guide Specifications:

CEGS - 15603 Warm Air Heating Systems

CEGS - 15775 Built-Up Heat Pump System

CEGS - 15804 Ventilation and Exhaust Systems

G. Drawings: All mechanical work is shown on standard drawings

2. PLUMBING

A. Basic Analysis: No changes to the plumbing system as shown on standard drawings has been made except to add one additional commode to latrine.

B. List of Guide Specifications

CEGS - 15400 Plumbing General Purpose

7.3 SPECIAL CONSIDERATIONS

N/A

7.4 DETAILED DESIGN CALCULATIONS

See Appendix 2

CHAPTER 8

ELECTRICAL

8.1 GENERAL

- A. The electrical design is a site adaptation from manual Number HNDEM-1110-1-5 issued by U.S. Army Corps of Engineers, Huntsville Division, dated March 1985, entitled "Design Information for Infantry Rifle Marksmanship Ranges.

8.2 INTERIOR ELECTRICAL DISTRIBUTION SYSTEMS

- A. All secondary (or utilization) voltage will be single-phase, 60 hertz, 3-wire system: at 120 volts for lighting, and miscellaneous loads; and at 240 volts for target mechanisms, electric heating equipment, and flood lighting. The buildings to be served and their connected loads are as follows:
 - 1. Control Tower - 22 KVA
 - 2. Target Mechanisms (through Control Tower) - 12 targets per lane x 16 firing lanes, or 192 targets; at an assumed 300 watts per target (actual rating is not given) the connected load is $192 \times 300 = 57.6$ KVA for MODIFIED AUTOMATED RECORD FIRE RANGE.
 - 3. Range Control Building - 5.0 KVA
 - 4. Latrine - 2.0 KVA
 - 5. Ammo Breakdown Building - 2.0 KVA
 - 6. Covered Mess - 3.0 KVA
 - 7. Floodlighting - 15 KVA
 - 8. Total connected load - 107 KVA for MARF RANGE.

B. Lighting System

Building and Room	Intensity (foot-candles)	Lamp	Basis
Control Tower	50	Fluorescent	Manual
Range Control Bldg.	50	Fluorescent	Manual
Ammo Breakdown Bldg.	30	Incandescent	Manual
Covered Mess	20	Incandescent	Manual
Latrine	20	Incandescent	Manual
Floodlighting	0.5	Incandescent (Quartz)	DOD 4270.1-M

C. Rigid conduit will be used in the latrine, the covered mess, for all service conduit masts and entrances, all underground runs, in the Ammo Breakdown Building, and all conduit exposed to the atmosphere (as on the Control Tower exterior). EMT will be used inside the Range Control Building and inside the Control Tower.

1. Wire shall be: stranded copper in and from the Control Tower: in other locations conductors No. 10 AWG and smaller gauge will be solid and No. 8 and larger shall be stranded. Conductors will be insulated with plastic, type "THW" or "THWN" 600 volts AC.

D. A heat pump with a supplementary electric resistance heater will be provided in the Control Tower.

E. The target mechanisms will be controlled by computer-programmer located in the Control Tower through hard wire connecting cables.

F. Communications

1. Provisions will be made for the installation and connections of a public address system on each range. The Government will furnish the equipment. Contractor will furnish wiring and speaker connectors.
2. No fire alarm systems are required.
3. Telephone service drops will be provided to the Control Tower and to the Range Control Building. Telephone equipment and service connections will be provided by the contractor. The telephone lines will be extended from the Range Control Building and Control Tower to the existing Range Control Headquarters by the contractor and connected to the existing base telephone system. The length of this run is approximately 4,700 feet and will be installed on the existing pole line leading from the Range Control Headquarters to the site of the proposed range.

4. Intrusion detectors will be installed in the Control Tower and in the storage room of the Range Control Building. The detectors will be either ultrasonic motion detectors, or the infrared beam type. They will be connected by dedicated telephone wires to the Range Control Headquarters. Supply and installation of alarm system by Government, power by contractor.
- G. The Ammo Breakdown Building is classified as a Class II, Division 2 hazardous area.
- H. Lightning protection will be provided:
 1. On the steel structure of the Control Tower.
 2. On the primary electrical distribution system.
 3. By installing surge protectors at the "Down Range" power panel in the tower, and also at the service entrance of the Ammo Breakdown Building.
- I. A static grounding system will be provided for the steel structure of the control tower and another grounding system for the electronic control equipment in the tower.
- J. The design guide manual calls for two transformers: one for the tower equipment and one for the target mechanisms. In this layout, three transformers are provided, to: better balance the load on the 3 phases of the primary line; and to reduce the wire size and length of runs of the secondary distribution.
 1. The target mechanism VA rating is not known at this time nor is the diversity factor of the down range load in full operation.
- K. The following Guide Specifications will be used:

CEGS-16415

Electrical Work Interior

8.3 EXTERIOR ELECTRICAL DISTRIBUTION SYSTEM

- A. The primary supply is adequate to serve the new range.
- B. The existing primary line is at 4160 volts, 3-phase, 3-wire.
- C. The estimated total connected load is 107 KVA. The estimated demand and diversity factors combined is 0.80×107 , or 86 KVA.

- D. The primary electric line is a new line. The secondary voltage is set at 120/240 volts single phase because the individual loads are small and of single-phase, and the computer equipment needs a separate transformer.
- E. The primary electric aerial line will be 3-#2/0 aerial cable with messenger. The secondary electrical aerial line will be stranded aluminum conductors, insulated, "triplexed", neutral messenger supported, run on poles. Service drops to buildings will also be triplex aluminum cables supported on a bare neutral messenger of stranded aluminum.
- F. The primary aerial line and secondary service will be supported on Class 3 poles with a primary minimum clearance of 22 feet over service roads and a secondary minimum clearance of 18 feet over service roads. Transformers will be oil-filled, single-phase, Class A, two primary bushings, 2400/4160Y/120/240 volts with taps plus or minus 2-2 1/2% on primary and pole-mounted.
1. The down-range secondary distribution and control connections will be underground with direct-burial cables, from the Control Tower to the connection box in each target mechanism coffin.
 2. Along firing line all wiring will be underground (in addition to paragraph (1) above), including: wiring to floodlighting; wiring to loud speakers and night-lighting fixtures.
- G. Floodlighting will be provided along the "ready line" and the firing line with average intensity of 0.5 foot candles using 1,500 watt quartz lamped fixtures, mounted on Class 5 utility poles. Connections will be underground with direct-burial cable.
- H. The following Guide Specifications will be used:
- | | |
|------------|---|
| CEGS-16401 | Electrical Distribution and Street Lighting System; Aerial |
| CEGS-16402 | Electrical Distribution and Street Lighting System; Underground |
- I. Cathodic protection is not required.

8.4 DRAWINGS:

- A. Exterior Electrical Site Plan.

See sheets 2 and 5 and STND DRWG E-1.

B. Interior Electrical
STND DRWG

<u>NO.</u>	<u>Title</u>
A-5	Standard Bldg. No. 2 - Plan & Elevations
A-7	Latrine
A-8	Ammo. Breakdown Bldg.
A-9	Covered Mess - Plans & Sections
**A-11	Bleacher Enclosure
E-1	Range Power & Data Wiring Plan
E-2	Control Tower Electrical Plan
E-3	Control Tower Electrical Details
E-4	Miscellaneous Electrical Details
E-5	Cable Junction Box
E-6	Tower Junction Box

** Drawing not available for concept package. Will be included in future submittals.

8.5 CRITERIA NEEDED TO COMPLETE FINAL DATA:

A. Following items are needed to complete the design:

1. Short circuit capacity available at the range sites.
2. Grounding requirements of primary neutral.
3. Availability of primary neutral to be extended to range site.
4. Specifications including connector types for Government furnished PA system.
5. Load and demand for IRETS equipment.
6. Isolation requirements for IRETS equipment should a generator provide power.
7. Provide locations of pole mounted floodlights so as not to interfere with the visibility of the ranges from the Control Tower.
8. Current design directives call for placing power and data cables to the locations of all stationary and moving target emplacements and to the hostile fire simulators. However, it is understood that the moving target emplacements have been permanently dropped from the IRETS program. Verification of the deletion of the moving targets and emplacements is required before final design is started. Deletion of these items will eliminate the need to run power and data cables to these locations.

CHAPTER 9

EROSION CONTROL AND LANDSCAPING

9.1 EROSION CONTROL

- A. Ranges G and G-A and the Engineer Demonstration area will require erosion control measures. The primary function will be to stabilize the soil after construction to eliminate or minimize wind and water erosion. The majority of the area, including the safety berms, firing line, and target emplacement berms will be treated with fertilizer, lime and seeded with rough meadow grasses which may include clover or crown vetch. Low growing shrub plantings to visually naturalize the downrange area will also be provided. Plantings chosen will need to be maintenance and disease free and of a type which will not outgrow their intended purpose.
- B. A field investigation revealed a poor environ with little or no topsoil. Grasses and plants found growing on the site include:
 - 1. Herbacious plants
Clover (*Trifolium repens*)
Several Meadow grasses
Queen Anne Lace (*Daucus cartota*)
Milkweed (*Asclepiors syriaca*)
 - 2. Shrubs and Vines
Virginia Creeper (*Parthenocissus quinquefolia*)
Garden Rose (*Floubunda*) (*Rosa floribunda*)
Sweet Fern (*Comptonia peregrina*)
 - 3. Trees
Black Oak (*Quercus velutina*)
Pin Cherry (*Prunus pensylvanica*)
Poplar (*Pupulus tremuloides*)
Pitch Pine (*Pinus rigida*)
Locust (*Robina pseudoacacia*)

9.2 LANDSCAPING

Landscaping will be limited to that which is necessary to stabilize the soil and naturalize the area. Plantings will be limited to those which can survive the environment as indicated by those found in the area and those listed in 9.1B above.

9.3 LIST OF GUIDE SPECIFICATIONS

<u>TITLE</u>	<u>NUMBER</u>
Turf	CEGS 02485
Trees, Shrubs, Ground Covers and Vines	CEGS 02490
Grading	CEGS 02210

CHAPTER 10

ESTIMATE

10.1 CONSTRUCTION COST ESTIMATES

- A. Following is a summary of the programmed and concept design construction cost estimates.

	<u>Programmed</u> (1391)	<u>Concept Design</u> (35%)
Total:	\$890,000	\$1,725,000

A detailed breakdown of these estimates is included at the end of this chapter. Backup data for the concept design estimate is included in Appendix 1. Data extracted from the backup has been reformulated to enable a comparison between the programmed and concept estimates.

- B. The large discrepancy between the programmed and concept design estimates is primarily due to two items; site improvements and the cost escalation factor.
1. The concept design included items in the site improvements which were not covered in the 1391. These items, and reasons for their inclusion in the concept design, follow:
 - a. Raised Firing Line - Necessary to allow for target acquisition, engaging, shifting and adjustment of fire. Without a raised berm, the majority of the targets would not be visible from the firing positions unless the targets were themselves raised. Raising the targets would result in an individual firing above a horizontal plane which is unacceptable from a safety standpoint.
 - b. Lateral Safety Berms - Necessary to provide protection to other ranges located down-range and left (east) of this range and for the proposed SAW range to be located to the right (west) of this range.

- c. Demolition - Includes clearing and grubbing about 9 acres of woodland. This is necessary to allow construction of the proposed range.
 - d. Landscaping - Required to stabilize the existing soil which is susceptible to wind erosion and to break up the "pool table" effect of the terrain where this range is being sited.
2. Escalation of the construction cost to mid-point of construction (July 1990) is necessary to take into account material and labor cost increases which may occur in the interval between concept design and construction and to comply with guidance criteria governing the preparation of concept design cost estimates.

The escalation factor, 17%, was obtained from the Engineering Improvement Recommendation System (EIRS) Bulletin 84-01, Table IV Tri-Service Military Construction Program (MCP) Index for FY86 Program.

ESTIMATE SUMMARY

MODIFIED AUTOMATED RECORD FIRE RANGE

	<u>Estimate (X1000)</u>	
	<u>Programmed</u>	<u>Concept</u>
PRIMARY FACILITY	734	884
Range Building	(28)	(62.5)
Ammo Issue Building	(8)	(16.5)
Latrine	(29)	(28.8)
Control Tower	(45)	(56.1)
Mess Shed	(28)	(22.3)
Lister Bag Holder	(4)	(0)
Heater Oil Tank	(1)	1/
Flag Pole	(1)	2/
PA System	(16)	3/
Range Lighting	(31)	(157.0)
Foxholes	(10)	(10.4)
Target System Wiring	(323)	(284.0)
Target Emplacement	(140)	(90.0)
Range Road	(42)	(106.6)
Covered Bleacher	(14)	(17.8)
General Maint./Park Area	(14)	(32.0)
SUPPORT FACILITIES	65	452.5
Site Improvements	(45)	(422.3) 4/
Electrical Service	(17)	(23.7)
Communication	(3)	(6.5)
Sub-Total:	799	1336.5
Cont. 5%:	<u>40</u>	<u>66.8</u>
Total Contract Cost:	839	1403.3
Supv., Inspect. & OH 5.5%:	<u>46</u> (5%)	<u>70.2</u>
Total:	885	1473.5
Escalation to Construction		
Midpoint (July 1990) 17%	<u>-</u>	<u>250.5</u>
TOTAL:	885	1724.0
TOTAL ROUNDED:	890	1725.0

Notes:

- 1/ Included with Range Building.
- 2/ Included with Site Improvements.
- 3/ Included with Range Lighting.
- 4/ Includes:

a. Demolition	-	43.4
b. Safety Berms	-	205.0
c. Raised Firing Line	-	94.2
d. Landscaping	-	79.1

CHAPTER 11

DEMOLITION/REMOVAL AND TREE CLEARING

11.1 GENERAL

- A. As designated on the demolition plan (sheet 3) the following structures will be demolished or removed from the area.
1. ENGINEER DEMONSTRATION AREA
 - a. Latrine (1 ea)
 - b. Bit. Conc. Pavement (5,800 s.y.)
 - c. Telephone pedestals (6 ea)
 - d. Clearing & Grubbing (3.6 acres)
 2. Ranges G and G-A
 - a. Covered bleachers
 - b. Covered mess area
 - c. Ammo distribution shelter
 - d. Target frames
 - e. Clearing & grubbing (5.3 acres)
 - f. Lyster Bag Holder
- B. The contracting officer will determine which, if any, items will be salvaged.

11.2 GUIDE SPECIFICATIONS

<u>TITLE</u>	<u>NUMBER</u>
Demolition	CEGS-02050
Clearing and Grubbing	CEGS-02100

APPENDICES

1. ESTIMATE BACK-UP DATA
2. CALCULATIONS
3. SITE VISITS, MEETINGS AND TELEPHONE CONTACTS
4. INDEX OF DRAWINGS
5. DESIGN DIRECTIVE

APPENDIX 1

ESTIMATE BACK-UP DATA

CONSTRUCTION COST ESTIMATE

DATE PREPARED

July 1986

SHEET

OF

PROJECT

MARF ~ Range

LOCATION

Fort Devens, MA

ARCHITECT ENGINEER

LISACENED

BASIS FOR ESTIMATE

☐ CODE A (No design completed)☐ CODE B (Preliminary design)☐ CODE C (Final design)☒ OTHER (Specify) 35%

DRAWING NO.

ESTIMATOR

S

CHECKED BY

SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
Recapitulation							
MARF RG 4 G-A							
EEDA							
Civil							\$628,819
Mechanical							16,374
Electrical							512,403
Control Tower							46,401
Latrine							26,127
Person. Storage							53,660
Ammo Breakdown							14,621
Covered Mess							20,053
Bleacher Encl.							17,765
Construction Cost							\$1,336,228
Contingency	5	%					66,811
Sub-Total							\$1,403,039
S&A	5	%					70,152
Total							\$1,473,191
Escalation July '90	17	%					250,442
CWE							\$1,723,633

CONSTRUCTION COST ESTIMATE				DATE PREPARED 3 JUL 86		SHEET 1 OF 3	
PROJECT MARF RANGE -				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input checked="" type="checkbox"/> OTHER (Specify) 35%			
LOCATION FT. DEVENS, MA.							
ARCHITECT ENGINEER							
DRAWING NO.		ESTIMATOR		CHECKED BY			
CIVIL SUMMARY	QUANTITY	LABOR		MATERIAL		TOTAL COST	
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT		TOTAL
I. SITE PREPARATION							
A. CLEARING & GRUBBING							
1) RANGE	8.9 AC.		\$1000	\$8,900	\$1000	\$8,900	
B. DEMOLITION							
1) SUPPORT FACILITY							
a.) COVERED MESS(WOOD)	1	EA.	\$400	400	\$100	100	
b.) AMMO AREA	2	EA.	\$400	800	\$100	200	
c.) BLEACHERS W/ COVER(WOOD)	1	EA.	\$400	400	\$100	100	
2) RANGE							
a.) LATRINE (WOOD)	1	EA.	\$400	400	\$100	100	
b.) REMOVE EXIST.							
TELEPHONE PEDESTAL	6	EA.	\$50	300	\$50	300	
c.) REMOVE EXIST.							
TARGET FRAMES	26	EA.	\$10	260	\$10	260	
d.) REMOVE EXIST.							
BIT. CONC. PAVEMENT	5,800 S.Y.		\$0 ⁶⁰	3,480	\$0 ⁶⁰	3,480	
II. EARTH WORK							
A. RANGE							
1.) EXCAVATION (TO BE RE-USED AS FILL)	12,000 C.Y.		\$1 ⁰⁰	12,000	\$2 ⁰⁰	24,000	
2.) FILL	25,000 C.Y.		\$1 ⁰⁰	25,000	\$4 ⁰⁰	100,000	
III. SITE IMPROVEMENTS							
A. SUPPORT FACILITY							
1.) 24' SERVICE ROAD							
a.) 3" BIT. CONC. PAVEMENT	520 S.Y.		\$5 ⁰⁰	2,600	\$5 ⁰⁰	2,600	
b.) 12" COMP. GRAVEL	170 C.Y.		\$7 ⁰⁰	510	\$7 ⁰⁰	1,190	
2.) 12' SERVICE ROAD							

CONSTRUCTION COST ESTIMATE				DATE PREPARED 3 JUL 86		SHEET 2 OF 3	
PROJECT MARF RANGE -				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input checked="" type="checkbox"/> OTHER (Specify) 35%			
LOCATION FT. DEVENS, MA.							
ARCHITECT ENGINEER							
DRAWING NO.		ESTIMATOR		CHECKED BY			
CIVIL (CONT'D.)	SUMMARY	QUANTITY	LABOR	MATERIAL		TOTAL COST	
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL		
1. 18" COMP. GRAVEL	860	L.Y.	\$3.00	\$2,580	\$7.00	\$6,020	
3. PARKING AREA 'A'							
1. 3" BIT. CONG.							
PAVEMENT	304	S.Y.	\$5.00	1,520	\$5.00	1,520	
6. 12" COMP. GRAVEL	100	L.Y.	\$3.00	300	\$7.00	700	
4. PARKING AREA 'B'							
1. 18" COMP. GRAVEL	140	L.Y.	\$3.00	420	\$7.00	980	
5. PATHS							
1. 6" COMP. GRAVEL	9	L.Y.	\$3.00	27	\$7.00	63	
B. RANGE							
1. 12' SERVICE ROAD							
1. 18" COMP. GRAVEL	7,000	L.Y.	\$3.00	21,000	\$7.00	49,000	
2. FIRING LINE							
1. FOX HOLES (16 REQ'D)							
1. PRECAST CONG.	16	L.Y.	\$12.50	2,000	\$12.50	2,000	
2. SAND BAGS	16	EA.	\$5.00	80	\$5.00	80	
3. AGGREGATE BASE	11	L.Y.	\$3.00	33	\$7.00	77	
4. 4" PVC DRAIN	320	L.F.	\$1.25	384	\$1.00	320	
5. PLATFORM (WOOD) -							
16 EA.	570	B.F.	\$1.00	570	\$0.50	285	
6. COVER (WOOD) -							
16 EA.	738	B.F.	\$1.00	738	\$0.50	369	
6. LANE MARKERS -							
16 EA.	60	B.F.	\$1.00	60	\$0.50	30	
3. TARGETS							
1. STATIONARY (192 REQ'D)							
1. PRECAST CONG.	230	L.Y.	\$12.50	28,750	\$12.50	28,750	
2. AGGREGATE BASE	260	L.Y.	\$3.00	780	\$7.00	1,820	
3. COMP. RANDOM FILL	440	L.Y.	\$2.00	880	\$2.00	880	
4. R.R. TIES - 7" X 8"	580	L.F.	\$10.00	5,800	\$16.00	9,280	

SHEET 3 OF 3

☒ OTHER (Specify) 35%.

CONSTRUCTION COST ESTIMATE				DATE PREPARED 5/22/86		SHEET 2 OF 3	
PROJECT RETS - FORT DEVENS				BASIS FOR ESTIMATE			
LOCATION South Post				<input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) 35% <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify)			
ARCHITECT ENGINEER NED							
DRAWING NO. VARIOUS		ESTIMATOR ATM		CHECKED BY			
SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
<u>LATRINE</u>							
S.S. Hoppers	6	ea	2	12	250	1500	
S.S. Urinal	1	ea	8	8	914	914	
Power roof vent 250 afm curb	1 1	ea ea	3 3	3	380	380	
Gravity vent 24" curb	1 1	ea ea	2 2	2	195	195	
Air Compressor 13.5 afm @ 3psig	1	ea	4	4	681	681	
S.S. vault by estimating unit							
Misc. piping, etc						LS	500

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE					DATE PREPARED 5/22/80		SHEET 3 OF 3	
PROJECT RETS - FORT DEVENS					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) 35% <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION SOUTH POST								
ARCHITECT ENGINEER NED								
DRAWING NO. VARIOUS			ESTIMATOR ATM		CHECKED BY			
SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST	
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL		
Summary								
Tower				12		1445-		
				X 25				
				\$ 300				
						TOTAL	1745-	
						21% O&P	366 603-	
							2343-	
							2111	
Instruction Bldg				29.5		2123-	500-	
				X 25				
				737.50				
						TOTAL	3360.50	
						21% O&P	705.-	
							\$ 4065-	
Latrine				29		3670	500	
				X 25				
				725				
						TOTAL	4895-	
						21% O&P	1020-	
							\$ 5923-	
							\$ 12,099	
						TOTAL	12,336-	
* By Est. Unit							1,000	
Sub-Contr. Cost							\$13,099	
Prime Contr. Mark Up	25	%					3,275	
Construction Cost							\$16,374	

CONSTRUCTION COST ESTIMATE				DATE PREPARED 7-1-86		SHEET 2 OF 9	
PROJECT <u>IRBTS - MARF</u>				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <u>SOUTH POST FT DEVENIS AYER MA</u>							
ARCHITECT ENGINEER <u>NED</u>							
DRAWING NO.		ESTIMATOR		CHECKED BY			
DISTRIBUTION Sys SUMMARY	QUANTITY <small>NO. UNITS</small>	<small>UNIT MEAS.</small>	LABOR <small>PER UNIT MH</small>	<small>TOTAL MH</small>	MATERIAL <small>PER UNIT</small>	<small>TOTAL</small>	TOTAL COST
SECONDARY BRACKET	4	BA	.75	3	15 ⁰⁰	60	
40' CL 3 POLE	4	EA	9.0	36	175 ⁰⁰	760	
HENDRY BM 14 BRACKET	2	BA	1.0	2	19 ⁰⁰	38	
" TS-1 STIRUP	2	BA	.25	1	6 ⁰⁰	12	
" SPACERS	16	BA	.25	4	5 ⁵⁰	88	
" DEADEND BRK	2	BA	.5	1	45 ⁰⁰	90	
# 2/0 AL AERIAL CABLE	1500	LF	.028	42	1 ⁶⁵	2475	
.252 ANA MESSENGER	500	LF	.012	6	75 ⁰⁰	375	
5KV DEADEND INSUL	12	BA	1.0	12	15 ⁰⁰	180	
5KV FUSED CUTOUTS	6	BA	2.0	12	54 ⁰⁰	324	
3KV SURGE ARRESTORS	6	BA	2.0	12	50 ⁰⁰	300	
10KVA 2400/120/240 XFMR	1	EA	7.0	7	564	564	
75KVA 2400/120/240V XFMR	1	BA	18.0	18	1787	1787	
100 KVA 4/60/120/240V XFMR	1	EA	20.0	20	2316	2316	
3# 2 TRIPLEX 300V	110	LF	.01	1	.76	84	
3# 6 TRIPLEX 300V	50	LF	.007	1	.46	23	
2" GRS	20	LF	.14	3	1 ²⁵	36	
2" GRS AL BOW	2	EA	1.0	2	8 ⁵⁰	17	
2" PVC	240	LF	.08	19	57	137	
2" PVC TERMS	2	EA	.30	1	2 ⁰⁰	5	
TRENCH	260	LF	.02	5	.79	205	
BACKFILL	15	CY	.42	6	2 ¹⁰	32	
12 PR # 24 TELEPHONE	4700	LF	.009	42	.50	2350	
# 8 THW 600V	800	LF	.010	8	.31	296	
# 4/0 XHHW 600V	20	LF	.031	1	1 ²⁰	21	
# 250 MM 600V	30	LF	.034	1	1 ⁴⁰	42	
TELE POLE BRACKET	31	EA	.75	23	15 ⁰⁰	465	
3/4" X 10' CU GND ROD	2	BA	1.25	3	10 ⁰⁰	20	
# 6 CU BARS	120	LF	.02	2	.16	19	
SUB-TOTAL				294 MH		13061	

SHEET 3 OF 9

PROJECT

IRcTs - MARE

LOCATION

SOUTH POST FT DEFENS AYBR MA

ARCHITECT ENGINEER

NBD

Basis for Estimate	
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☐ CODE A (No design completed)

~~CODE~~ CODE B (Preliminary design)

☐ CODE C (Final design)☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR

CHECKED BY

<u>Covered</u> Mess SUMMARY	QUANTITY			LABOR	MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT MH	TOTAL MH	PER UNIT	TOTAL	
2" GRS	10'	LF	.14	1	1 ⁷⁹	18	
2" " WEATHER HEAD	1	EA	.70	1	9 ²⁰	9	
2SDA PANEL BOARD 1¢	1	EA	4.0	4	290 ⁰⁰	290	
3W 60A MAIN & SPARE							
20A 120V CB	4	EA	.30	1	31 ⁵⁰	126	
1/2" GRS	85'	LF	.05	4	.53	45	
1/2" " TERMS	16	EA	.08	1	.50	8	
4" JUNCTION BOX	8	EA	.30	2	3 ⁴⁹	28	
DUPLEX RECEPT 120V	2	EA	.35	1	9 ⁰⁰	18	
WEATHER PROOF PLATE	2	EA	.20	—	10 ¹⁵	20	
BLANK PLATE	6	EA	.1	1	.38	2	
#2 TH 600V	30	LF	.18	5	.44	13	
#12 TH 600V	150	LF	.007	1	.13	20	
120V LIGHT FIXTURE	6	EA	.70	4	25 ⁰⁰	150	
#6 BARS CU	20	LF	.20	4	.16	3	
3/4" X 10' CU GND ROD	1	EA	1.25	1	10 ⁰⁰	10	
SUBTOTAL				31MH		760	

SHEET 4 OF 9

☐ OTHER (Specify) _____

CHECKED BY

<u>KATRINA BLDG</u> SUMMARY	QUANTITY			LABOR	MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT MH	TOTAL MH	PER UNIT	TOTAL	
2" GRS	10	LF	.14	1	1 ⁷⁹	18	
2" " TERMS	1	EA	.70	1	2 ⁹⁰	3	
60A 120/240V PANE(BOARD)	1	EA	4.0	4	130 ⁰⁰	130	
1# 3W E SPACES							
20A 120V CB	3	EA	.30	1	31 ⁵⁰	95	
15A 120V CB	1	EA	.30	—	31 ⁵⁰	32	
4" JUNCTION Box	17	EA	.30	5	3 ⁴⁹	59	
PLATE	10	EA	.10	1	.38	4	
20A 120V SWITCH	6	EA	.45	3	6 ⁷⁵	41	
20A 120V Duplex	3	EA	.35	1	9 ⁰⁰	27	
1/2" GRS	140	LF	.05	7	.53	74	
1/2" GRS Terms	30	EA	.08	2	.50	15	
#12 TH 600V	300	LF	.007	2	.13	39	
OUTSIDE LIGHT FIXTURE	3	EA	.65	2	.35	105	
INDOOR LIGHT FIXTURE	4	EA	.70	3	31 ⁰⁰	124	
#6 BARE CU	20	LF	.20	4	.16	3	
3/4"x10' CU GND Rod	1	BA	1.25	1	10 ⁰⁰	10	
CONNECT Power VENT	1	BA	1.0	1	10 ⁰⁰	10	
CONNECT AIR COMP	1	EA	1.0	1	10 ⁰⁰	10	
SUBTOTAL				40 MH		799	

7-1-86

SHEET 3 OF 9

PROJECT

TRÖTS - MARF

LOCATION

LOCATION SOUTH-POST FT Devens Ayer MA

ARCHITECT ENGINEER

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☐ CODE A (No design completed)

~~CODE~~ B (Preliminary design)

☐ CODE C (Final design)☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR

CHECKED BY

RANGE BLDG	SUMMARY	QUANTITY			LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT MH	TOTAL MH	PER UNIT	TOTAL		
2" GRS	10'	LF	.14	1	1 ⁷⁹		18		
2" GRS TERMS	1	EA	.76	1	9 ²⁰		9		
100A 120/240V Panel(BOARD)	1	EA	5.0	5	225		225		
1¢ 3w 100A MAIN 12 SPACE									
120 V 20A CB	8	EA	.30	2	31 ⁵⁰		252		
3/4" X 10 CU GND Rod	1	EA	1.25	1	10 ⁰⁰		10		
#6 BARE CU	20	LF	.20	4	.16		3		
OUTDOOR LIGHT FIXTURE	2	EA	.65	1	35 ⁰⁰		70		
INDOOR LIGHT FIXTURE	4	EA	.85	3	31 ⁰⁰		124		
DUPLEX RECP 20A 120V	6	EA	.35	2	9 ⁰⁰		54		
20A 120V SWITCH	6	EA	.45	3	6 ⁷⁵		41		
4" JUNCTION Box	20	EA	.30	6	3 ⁴⁰		70		
Box Plate	14	EA	.10	1	.38		5		
1/2" EMT	250	LF	.04	10	.25		63		
1/2" EMT TERMS	29	EA	.08	3	.35		14		
CONNECT FURNACE	1	EA	1.00	1	10 ⁰⁰		10		
CONNECT POWER VENT	1	EA	1.00	1	10 ⁰⁰		10		
# 12 THW 600V	500	LF	.007	3	.13		65		
TELEPHONE TERM	1	EA	.50	1	7 ⁵⁰		8		
12 PR # 24 TELEPHONE	50	LF	.008	—	.50		25		
TELEPHONE OUTLET	1	EA	.50	1	10 ⁰⁰		10		
INTRUSION SYSTEM	1	EA	8.0	8	750 ⁰⁰		750		

CONSTRUCTION COST ESTIMATE

DATE PREPARED

7-1-86

SHEET 2 OF 3

PROJECT

TRÖTS - MARF

LOCATION

SOUTH POST - FT DUVENS AYOKEMA

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

☐ CODE A (No design completed)

~~SECRET~~ CODE B (Preliminary design)

☐ CODE C (Final design)☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR

CHECKED BY

<u>AMMO ISSUE</u>	SUMMARY	QUANTITY		PER UNIT MH	LABOR	MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.		TOTAL MH	PER UNIT	TOTAL	
2" GRS		10	LF	.14	1	1 ⁷²	18	
2" GRS Term		1	EA	.70	1	9 ²⁰	9	
60A PANEL BOARD 1φ 3W		1	EA	4.0	4	130 ⁰⁰	130	
40A MAIN 8 SPACES								
20A 120V CB		4	EA	.30	1	31 ⁵⁰	126	
1/2" GRS		80	LF	.05	4	.53	42	
1/2" GRS Terms		17	BA	.08	1	.50	9	
#12 THW 600V		160	LF	.007	1	.13	21	
DUPLEX REC 20A		3	BA	.35	1	9 ⁰⁰	27	
20A 120V SWITCH		2	BA	.45	1	6 ⁷⁵	14	
4" OUTLET Box		9	EA	.30	3	3 ⁴⁹	31	
Box PLATE		5	BA	.10	1	.38	2	
#6 BARE CU		20	BA	.20	4	.16	3	
3/4" x 10' CU GND Rod		1	BA	1.25	1	10 ⁰⁰	10	
OUTSIDE LT FIXTURE		3	EA	.65	2	35 ⁰⁰	105	
INDOOR LT FIXTURE		2	BA	.70	1	31 ⁰⁰	62	
SUBTOTAL					27MH		609	

CONSTRUCTION COST ESTIMATE

DATE PREPARED

7-1-86

SHEET 7 of 9

PROJECT

IRBTS - MARF

LOCATION

SOUTH POST FT Devens Ayer MA

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

☐ CODE A (No design completed)

☒ CODE B (Preliminary design)

☐ CODE C (Final design)

☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR

CHECKED BY

CONTROL Tower SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT MH	TOTAL MH	PER UNIT	TOTAL	
2 1/2" GRS	10	LF	.016	—	3.20	32	
2 1/2" " TERMS	2	EA	.10	1	6.00	12	
225A PANELBOARD 1φ 3W	1	EA	8.0	8	4.00	4	
225A MAIN 20 SPACS							
20A 120V CB	6	EA	.30	1	31.50	189	
20A 120V CB 2P	1	EA	.45	—	51.00	51	
30 120V CB 2P	1	EA	.55	1	51.00	51	
CLOCK OUTLET	1	EA	.90	1	10.00	10	
20A 120V SWITCH	4	EA	.45	2	6.75	27	
20A 120V Duplex	6	EA	.35	2	9.00	54	
FLUORESCENT FIXTURE	2	EA	.85	2	35.00	70	
CEIL MOUNT FIX	2	EA	.65	1	30.00	60	
1/2" GRS	200	LF	.04	8	.25	50	
1/2" GRS TERMS	33	EA	.08	3	.35	12	
4X4 WIREWAY	10	LF	.12	1	43.00	430	
PA SYSTEM TERM BOX	1	EA	2.0	2	50.00	50	
TELEPHONE OUTLET	1	EA	.50	1	10.00	10	
TELEPHONE TERM	1	EA	.50	—	7.00	7	
12 PR #24 TELEPHONE	50	EA	.009	1	.50	25	
INTRUSION SYSTEM	1	EA	8.0	8	750.00	750	
#4/0 BARE CU	130	LF	.05	7	.96	125	
CADWELD CONN #4/0	28	BA	1.25	35	5.00	154	
3/4 X 10' CU GND ROD	7	BA	1.25	9	10.00	10	
AIR TERMINAL	2	BA	.50	1	40.00	40	
AIR TERM BRACKET	2	BA	1.0	1	25.00	50	
#12 THW 600V	360	LF	.007	3	.13	47	
STANCHION MOUNT FOR LTS	3	EA	1.5	5	50.00	150	
#10 THW 600V	90	LF	.009	1	.18	16	
SUBTOTAL				105MH		2567	

CONSTRUCTION COST ESTIMATE

DATE PREPARED

7-1-86

SHEET 8 OF 9

PROJECT

IRETS - MARF

LOCATION

SOUTH POST FT DEVENIS ABER MA

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR

CHECKED BY

RANGE	SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL MH	PER UNIT	TOTAL	
7"	GRS	6440	LF	.28	1803	5 ⁶²	36386	
4"	ELBOWS	8	EA	3.0	24	49 ⁸²	399	
4"	TERMS	16	EA	1.6	26	12 ⁹⁴	207	
1"	GRS	1610	LF	.16	258	1 ⁷²	2818	
1"	ELBOWS	32	EA	1.0	32	8 ³⁶	268	
2"	TERMS	64	EA	.75	48	1 ⁹⁷	120	
3/4" X 10'	CUGAND RD	200	EA	1.25	250	10 ⁸⁰	2000	
#6	TRAP	1120	LF	.02	22	.16	179	
CADWELD	CONN	200	EA	1.25	250	5 ⁵⁰	1100	
100A	4 JUNCTION BOX	24	EA	.30	7	35 ⁵¹	854	
4-6TWP	#19	20810	LF	.018	375	.17	3538	
100A	TRAP BOARD 120/240	1	EA	8.0	8	1400	1400	
1/2"	26 SPACES							
200V	2P 100A CB	16	EA	.75	12	86 ²⁰	1384	
1P	30A CB	1	EA	.35	—	31 ⁵⁰	32	
1P	30A CB	2	EA	.30	1	31 ⁵⁰	64	
30'	CLASS 5	8	EA	5.0	40	155 ⁸⁰	1240	
1"	GRS	120	LF	.06	7	.85	102	
1"	TERMS	32	EA	.35	11	.62	20	
1"	GRS	160	LF	.057	9	.13	101	
1"	GRS	24	EA	.26	6	.37	9	
3/4"	TRAP 30	40	LF	.013	1	.85	34	
SUPPRESSOR		8	EA	.50	4	36 ²⁰	288	
100A	1500 W	16	EA	4.5	72	300 ⁸⁰	4800	
TRAP		23810	LF	.02	476	.79	15310	
BACKFILL		2645	CY	—	—	5 ³⁰	13225	
SPEAKER MOUNT		8	EA	2.0	16	50 ³⁰	400	
DATA	TERMINAL BOX	1	EA	4.0	4	—	—	
#4	XLP 600V	25640	LF	.014	359	.44	11282	
SUBTOTAL					4121 MH		101060	

SHEET 9 OF 9

7-1-80

SHEET 9 OF 9

IRBTS - MARR

SOUTH-POST FT DEFENS AYER MA

NED

☐ OTHER (Specify) _____

CHECKED BY

[illegible]

CONSTRUCTION COST ESTIMATE				DATE PREPARED JULY 1966		SHEET 1 OF 2	
PROJECT RETS				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION FORT DEVENS, MASS.							
ARCHITECT ENGINEER							
DRAWING NO. CONTROL TOWER		ESTIMATOR W. HOLTHAM		CHECKED BY A. SIEGEL			
GEN. CONST. SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EARTHWORK							
EXCAVATION	40	CY	10	400		—	400.
BACKFILL	35	CY	15	525		—	525.
CONCRETE WORK							
FOOTING W/REINF.	1.5	CY	200.	300.	200.	300.	600.
PIERS W/REINF.	.8	CY	200.	160.	200.	160.	320.
GRADE B ₂ W/REINF.	4.1	CY	200.	820.	200.	820.	1640.
2 1/2" FLOOR SLAB							
W/REINF.	114	SF	1.00	114.	1.75	200.	314.
1 1/2" METAL DECK	114	SF	1.00	114.	2.50	285.	399.
STEEL FRAME							
MISC.	.43	TN	1000	430.	1500.	645.	1075.
STEEL STAIRS	25'	R	—	3250	—	500	3750.
1" GALV. STEEL GRATING	145	SF	1.60	232.	7.50	1088	1320.
1 1/2" " " RAILING	135	LF	500.	675.	30.	4050	4725.
4" x 1/4" KICK PLATE	180	LF	.60	108.	1.00	180	288.
INSULATED WALL PANEL							
" ROOF "	220	SF	2.00	440.	6.00	1320	1760.
" " "	440	SF	1.50	660.	3.00	1320	1980.
(2) 1 1/2" LAYERS FLOOR INSULATION							
	228	SF	.25	57.	1.00	228	285.
WINDOW (5'x5')							
" (5'x3')	4	EA.	50	200.	200	800.	1000.
	3	EA.	40	120.	120	360.	480.
DOOR (2'-8" x 6'-8")							
	1	EA.	50	50.	250	250	300.
HARDWARE							
	1	EA.	50	50.	150	150	200.
SUB TOTAL				13005		19106	32116.

SHEET 2 OF 2

RETS

FORT DEVENS, MASS.

☐ CODE A (No design completed)
☒ CODE B (Preliminary design)
☐ CODE C (Final design)
☐ OTHER (Specify)

CONTROL TOWER

ESTIMATOR
W. HOLTAM

CHECKED BY
A. SIEGEL

GPO : 1985 O - 467-225

CONSTRUCTION COST ESTIMATE				DATE PREPARED JULY '86		SHEET / OF 2	
PROJECT RETS				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION FORT DEVENS, MASS.							
ARCHITECT ENGINEER							
DRAWING NO. LATRINE		ESTIMATOR W. HOLTHAM		CHECKED BY A. SIEGEL			
GEN. CONST. SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EARTHWORK							
EXCAVATION	50	CY	10	500.		—	500.
BACKFILL	40	CY	15	600.		—	600.
CONCRETE WORK							
PRECAST CONC. TANK	1	EA	600	600.	1200.	1200.	1800.
M.H. COVER	1	EA	100	100.	300.	300.	400.
REINF. CONC. SLAB	216	SF	2 ⁰⁰	432	2 ⁵⁰	540.	972.
CONC. FOOTING	7.9	CY	76	600	63	498.	1098.
2" PERIM. INSUL.	320	SF	.35	112.	1 ⁴⁰	448.	560.
6 MIL VAPOR BARRIER	2.5	CFS	4 ⁰⁰	10	4 ⁰⁰	10	20.
6" CRUSHED STONE	3.0	CY	10	30	5 ⁰⁰	15	45.
PRE-ENG. BLDG							
FRAMING	LS		700	700	1800	1800.	2500.
METAL SIDING	475	SF	1 ²⁵	594	2 ⁰⁰	950.	1544.
METAL LINER	375	SF	1 ²⁵	469	2 ⁰⁰	750.	1219.
METAL ROOF	280	SF	1 ²⁵	350	1 ²⁵	350.	700.
METAL CEILING	200	SF	1 ⁰⁰	200	2 ⁵⁰	500.	700.
PARTITION	176	SF	3 ⁸⁵	678.	3 ⁵⁵	572.	1250.
GUTTER	48	LF	1.50	72	2 ⁹⁰	139.	211.
WINDOW 3'x3'-8"							
SECURITY SCREENS	3	EA	20	60	80	240	300.
DOOR W/ HARDWARE	2	EA	100	200	400	800	1000.
VENT UNIT	1	EA	50	50.	180	180.	230.
WATERLESS CLOSETS	7	EA	25	175.	340	2100.	2275.
S.S. URINALS	1	EA	25	25	200	200.	225.
TOTALS				6677		11952	18629.

SHEET 2 OF 2

RETS

FORT DEVENS, MASS.

Basis for Estimate

☒ CODE 8 (Preliminary design)

☐ OTHER (Specify) _____

LATRINE

ESTIMATOR
W. HOLTHAM

CHECKED BY
A. Siegel

GPO : 1985 O - 467-225

CONSTRUCTION COST ESTIMATE				DATE PREPARED JULY '86		SHEET 1 OF 2	
PROJECT RETS				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION FORT DEVENS, MASS							
ARCHITECT ENGINEER							
DRAWING NO. PERSONNEL/STORAGE			ESTIMATOR W. HOLTHAM		CHECKED BY A. SIEGEL		
GEN. CONST. SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EARTHWORK							
EXCAVATION	190	CY	10	1900.		—	1900.
BACKFILL	140	CY	15	2700.		—	2700.
CONCRETE WORK							
CONC. FOOTING	17.8	C.Y.	76	1353	63	1121	2474
4" SLAB W/ REINF.	824	SF	2 ⁰⁰	1648	25 ⁰⁰	2060	3708
2" PER. INSUL.	600	SF	.35	210.	14 ⁰⁰	840.	1050.
6 MIL VAPOR BARRIER	12	CFS	4 ⁰⁰	48	4 ⁰⁰	48.	96.
6" GRAVEL FILL	14.8	CY	20	296	20	296.	592.
PRE-ENG. BUILDING							
STEEL FRAMING	LS			1800		4200	6000.
METAL SIDING	1200	SF	125	1500	20 ⁰⁰	2400	3900
METAL LINER	1200	SF	125	1500	20 ⁰⁰	2400	3900
3 1/2" BATT. INSUL.	1200	SF	.25	300	.30	360	660
METAL ROOF	950	SF	125	1188	1.25	1188	2376
6" BATT INSUL.	900	SF	.25	225	.50	450	675
METAL CEILING	900	SF	100	900	25 ⁰⁰	2250	3150
WINDOW (3'x4')							
SECURITY SCREENS	8	EA	20	160	80	640	800.
DOOR w/ HARDWARE	2	EA	100	200.	400	800.	1000.
GUTTER	120	LF	150	180	2 ⁹⁰	348.	528.
TANK PEDESTALS	1.5	CY	76	114	63	95	209.
TOTAL				16542		21096	37638.

CONSTRUCTION COST ESTIMATE				DATE PREPARED JULY '86		SHEET 1 OF 1	
PROJECT RETS				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION FORT DEVENS, MASS.							
ARCHITECT ENGINEER							
DRAWING NO. AMMO BREAKDOWN		ESTIMATOR W. HOLTAM		CHECKED BY A. SIEGEL			
SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EARTHWORK							
EXCAVATION	35	CY	10	350.		—	350.
BACKFILL	30	CY	15	450.		—	450.
CONCRETE WORK							
FOOTING	6.5	CY	76	494	63	410	904
4" SLAB W/REINF	132	SF	2 ⁰⁰	264.	25 ⁰⁰	330.	594.
2" PER. INSUL.	220	SF	.35	77	1 ⁴⁰	308	385.
6 M.I. VAPOR BARRIER	2.5	SF	4 ⁰⁰	10.	4 ⁰⁰	10.	20.
6" x 4" GRANULAR FILL	3.0	CY	20	60.	20	60.	120
4" x 6" CONC. CURB	48	LF	5 ⁰⁰	240	35 ⁰⁰	168.	408.
PRE-ENG. BUILDING							
FRAMING	LS		600	600	1400	1400.	2000.
METAL SIDING	360	SF	1 ²⁵	375.	2 ⁰⁰	600.	975.
METAL LINER	300	SF	1 ²⁵	375.	2 ⁰⁰	600.	975.
METAL ROOF	276	SF	1 ²⁵	345.	1 ²⁵	345.	690.
METAL CLG.	120	SF	1 ⁰⁰	120.	25 ⁰⁰	300.	420.
FOLD DOWN PANEL	2	EA	100	200	50	100	300
DOOR W/HARDWARE	1	EA	100	100	400	400	500
RUBBER BUMPERS	6	EA	50	300	25	150	450
COUNTER PLASTIC LAM.	31	LF	5	155	18	558	713
PIPE POSTS							
TOTAL				4515			10254.
INSURANCE & TAXES							
	22	%					993.
CONTRACTOR MARKUP							
	30	%					3374.
CONSTRUCTION COST							
AMMO BREAKDOWN							\$14,621

CONSTRUCTION COST ESTIMATE				DATE PREPARED JULY '86		SHEET 1 OF 1	
PROJECT RETS				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION FORT DEVENS, MASS.							
ARCHITECT ENGINEER							
DRAWING NO. COVERED MESS		ESTIMATOR W. HOLTAM		CHECKED BY SIEGEL			
SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EARTHWORK							
EXCAVATION	25	CY	10	250		-	250
BACKFILL	10	CY	15	150		-	150
CONCRETE WORK							
COL. FOOTINGS	1	CY	76	76	63	63	139
4" SLAB W/REINF.	760	SF	2 ⁰⁰	1520	25 ⁰⁰	1900	3420
SHELF FOOTING	2	CY	76	152	63	126	278
THICKENED SLAB	4	CY	76	304	63	252	556
6" COMP. GRANULAR FILL	12	CY	20	240	20	240	480
PRE-ENG. BUILDING							
GALVANIZED SHELF (14ga)	156	S.F.	2 ⁰⁰	312	285	445	757
2" DIAM. GAL. PIPE	160	L.F.	.50	80	3 ⁰⁰	480	560
5" GAL. STEEL PIPE COL.	72	L.F.	1 ⁰⁰	72	3 ²⁵	234	324
METAL ROOF	840	S.F.	1 ²⁵	1050	1 ²⁵	1050	2100
PURLINS (6"x11")	1200	LB	.50	600	1 ⁰⁰	1200	1800
SUPPORT BEAMS (12"x11")	912	LB	.50	456	1 ⁰⁰	912	1368
BRACING (3"x11")	162	LB.	.50	81	1 ⁰⁰	162	243
MELTEN LEAD	LS			100.		200.	300.
BOLTS, PLATES ETC.	200	LB.	.50	100.	1 ⁰⁰	200.	300
WT 12x27.5 SHELF	908	LB	.25	227	1 ⁰⁰	908.	1135.
TOTAL				5770		8390	14160
INSURANCE & TAXES	22	%		(5770)			1269.
CONTRACTOR MARKUP	30	%		(15429)			4629.
CONSTRUCTION COST COVERED MESS						\$	20058

CONSTRUCTION COST ESTIMATE				DATE PREPARED JULY '86		SHEET 1 OF 1	
PROJECT RETS				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input checked="" type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION FORT DEVENS, MASS.							
ARCHITECT ENGINEER							
DRAWING NO. BLEACHER ENCLOSURE		ESTIMATOR W. HOLTAM		CHECKED BY A. SIGEL			
GEN. CONST. SUMMARY	QUANTITY	LABOR		MATERIAL		TOTAL COST	
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EARTHWORK							
EXCAVATION	35	CY	10	350.		-	350
BACKFILL	30	CY	15	450.		-	450
CONCRETE WORK							
FOOTINGS	2.3	CY	76	175	63	145	325
PRE-ENG. BUILDING							
FRAMING		L.S.	600	600	1400	1400	2000.
METAL SIDING	935	S.F.	125	1169	200	1870	3039.
WALL VENTS (2'x3')	4	EA	50	200	50	200	400
METAL ROOF	640	SF.	125	800	125	800	1600
STEEL FRAME	1.5	TN.	1000	1500	1500	2250	3750
SPLASH BED (GRAVEL)							
3' WIDE x 4" DEEP	1.2	CY	20	24	20	24	48
4"x6" TREATED WD. CURB	38	L.F.	200	76	400	152	228
4" GRAVEL FLOOR	6.75	CY	20	135	20	135	270
TOTAL				5479		6981	12460
INSURANCE & TAXES	22	%		(5479)			1205
CONTRACTOR MARKUP	30	%		(13665)			4100
CONSTRUCTION COST							
BLEACHER							\$ 17765
ENCLOSURE							

APPENDIX 2

CALCULATIONS

RETS - F+ Devens - Mechanical Input 35% Design

Note: Paragraph nos. below refer to paragraph nos. used in concept submission instructions dated Dec '99 (also similar to Camp Drum 35%)

1.17 HANDICAPPED REQUIREMENTS:

In accordance with PL90-480, no provisions for the handicapped will be made in the project since, in the foreseeable future, the facility will be used and operated solely by able-bodied personnel.

1.18 SOLAR STUDY:

Not applicable

1.19 ENERGY AUDIT:

a. None required

b. Energy Sources:

(1) Heating: Oil fired ^{hot air} furnace for heating storage building (std. bldg 2) and heat pump with supplementary electric heat for control tower. All other buildings are unheated.

(2) by elec unit NED

c. by others (elec unit NED)

d. Energy Conservation: Adequate insulation will be added to heated buildings to conserve energy.

- e. Energy Alternatives: N/A
- f. Energy Effects: N/A
- g. Basis of Appraisal: In consideration of energy sources and energy requirements, solar energy and selective energy sources have excluded as inapplicable.

CHAPTER 7 MECHANICAL

1. Heating, Ventilating and Air Conditioning

a. Basic Analysis:

(1) Basic Criteria Manuals: ASHRAE, DOD 4270.1-M

(2) Design Conditions:

(a) Inside: Summer 80°F (Tower only)
Winter 68°F (Tower & Std bldg 2)

Outside: Summer 2.5% DB 89°F
5% WB 73°F
Winter 1°F

(b) Personnel Load: 3 in control tower

(c) "U" Factors:

	<u>Tower</u>	<u>Std bldg 2</u>
Roofs	.10	.05
Walls	.10	.08
Glass	.55	.55
Doors	.59	.59
Floor	.11	—

(d) N/A

(e) Ventilation: no change to standard drawings

(3) Type of Systems:

- (a) The instruction building (std bldg #2) will have a roof exhaust fan for summer ventilation. Heat will be supplied by an oil fired warm air furnace.
- (b) The control tower will have a heat pump with supplementary electric heater.

(4) Temporary Outages that would affect the user: N/A

b. Calculations:

The control tower heating load is 14,094 Btu/h, and the cooling load is 22,027 Btu/h.

The instruction building (std bldg #2) heating load is 52,731 Btu/h.

A detailed listing of design computations is included at the end of this chapter.

c. Equipment:

(1) The equipment is basically as stated above and listed on standard drawings.

(2) For manufacturers upon whose equipment design is based see ~~detailed listing~~ detailed design calculations at the end of this chapter.

d. Piping Systems: N/A

e. Air Distribution Systems: N/A

2. Listing of Guide Specifications:

CEGS - 15603	Warm Air Heating Systems
CEGS - 15775	Built-Up Hot Pump System
CEGS - 15804	Ventilation & Exhaust Systems

g. Drawings: All mechanical work is shown on standard drawings.

2. Plumbing Basic Analysis

a. ~~No~~ changes to the plumbing system as shown on standard drawings has been made.

b. List of Guide specifications

CEGS - 15400 Plumbing General Purpose.

3. Special Consideration : N/A

4. Detailed Design Calculations

27 Sept 49

SUBJECT RIFLE RANGE FT DEVENS
 COMPUTATION CONTROL TOWER ETC
 COMPUTED BY ATM CHECKED BY _____ DATE 7 APRIL 86

DESIGN CONDITIONS

SUMMER 2.5% DB 89°F
 5% WB 73°F

WINTER 1°F

INSIDE CONDITIONS

SUMMER 80°F (TOWER ONLY)

WINTER 68°F (TOWER & STD BLDG 2)

ASSUME EQUIP. IN CONTROL TOWER 6000 BTU SENS OUT,

CONTROL TOWER

ROOF & WALL $U = .10$ (PER STD DWG)

FLOOR .08 FROM ASHRAE 90-75

INSIDE AIR	.92 ^w	.61 ^e
2 1/2" CONC	.20	.20
3" RIGID INSUL	8.33	8.33
OUTSIDE AIR	<u>.17^w</u>	<u>.25^e</u>
	9.62	9.84
	$U = .10$	$U = .11$

USE SUMMER U VALUE $U = .11$

DOOR 1 3/4" HOLLOW METAL $U = .59$
 w/ WIRED GLASS

WINDOW 1/2" INSULATED GLASS $U = .55$

27 Sept 49

CORPS OF ENGINEERS, U. S. ARMY

PAGE 2

SUBJECT RIFLE RANGE FT DEVENS
 COMPUTATION CONTROL TOWER
 COMPUTED BY ATM CHECKED BY _____ DATE 7 APRIL 86

NORTH EAST WALL

$$10'-8" \times 9'-0" = 96 \text{ sq ft } 70.1 \text{ net}$$

$$\text{DOOR } 2'-9" \times 6'-8" = 17.8 \text{ sq ft}$$

$$\text{WINDOW } 2'-6" \times 3'-3" = 8.1 \text{ sq ft}$$

NORTH WEST WALL

$$10'-8" \times 9'-0" = 96 \text{ sq ft } 54.7 \text{ net}$$

$$\text{FIXED WINDOW } 5' \times 5' = 25 \text{ sq ft}$$

$$\text{SLIDING WINDOW } 5' \times 3'-3" = 16.25 \text{ sq ft}$$

SOUTH WEST WALL

$$10'-8" \times 9'-0" = 96 \text{ sq ft } 41.6 \text{ net}$$

$$\text{FIXED WINDOWS } = 2 @ 5' \times 5' = 50 \text{ sq ft}$$

SOUTH EAST WALL

$$10'-8" \times 9'-0" = 96 \text{ sq ft } 54.7 \text{ net}$$

$$\text{FIXED WINDOW } 5' \times 5' = 25 \text{ sq ft}$$

$$\text{SLIDING WINDOW } 5' \times 3'-3" = 16.25 \text{ sq ft}$$

FLOOR AREA & ROOF AREA

$$10'-8" \times 10'-8" = 113.8 \text{ sq ft}$$

ROOF OVERHANG 4'-0"

27 Sept 49

SUBJECT RIFLE RANGE FT DEVENS
STANDARD BUILDING #2
 COMPUTATION
 COMPUTED BY ATM CHECKED BY _____ DATE 7 APRIL 86

WALLS

OUTSIDE AIR	.17	
METAL PANEL	NEGL.	
3 1/2" BATT INSUL	11.00	
META PANEL	NEGL.	
INSIDE AIR	.69	
	<u>11.85</u>	U = .08


ROOF

OUTSIDE AIR	.17	
METAL PANEL	NEGL	
6" INSUL	19.00	
METAL PANEL	NEGL	
INSIDE AIR	.61	
	<u>19.78</u>	U = .05

FLOOR SLAB ON GRADE (+.5')

$$40' \times 20' = 800 \text{ } \phi$$

NORTH WALL

20' x 10' +  $\frac{x}{2} = \frac{10}{12} = \frac{20}{12} = 1.7'$

+ 1.7 x 10 = 200 + 17 = 217 ϕ gr. 196 ϕ_{net}

DOOR 3' x 7' = 21 ϕ w / 14 ϕ LOUVER 40% F.A

SOUTH WALL

SAME AS NORTH

EAST WALL

40' x 10' = 400 ϕ gr 352 ϕ_{net}

4 WINDOWS @ 3' x 4' = 12' = 48 ϕ

WEST WALL SAME AS NORTH EAST

27 Sept 49

SUBJECT RIFLE RANGE FORT DEVENS

COMPUTATION

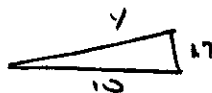
COMPUTED BY ATM

CHECKED BY

DATE 7 APRIL '86

PERIMETER 120'

ROOF



$$y = \sqrt{10^2 + 1.7^2} = \sqrt{102.89} = 10.1'$$

$$10.1 \times 40 \times 2 = 808 \text{ \#}$$

ZONE INPUT SHEET

ZONE NAME CONTRX TOWER

JOB NAME RETS / FT. DEVENS

COOLING SYSTEM DATA

Indoor Air

Indoor Summer Dry-Bulb 80 F.

(Enter Relative Humidity or Summer Wet-bulb
the other is calculated by program)

Indoor Summer Wet-Bulb _____ F.
or

Relative Humidity 50 %

Supply Air

Type of Input : (1) Cfm/sq ft
(2) Total Cfm
(3) Temperature

Supply Air (cooling) _____

Ventilation Air

Type of Input: (1) Cfm/sq ft
(2) Total Cfm
(3) % of supply air
(4) Cfm/Person

Ventilation Air 15

Cooling Safety Factor 5 %

HEATING SYSTEM DATA

Indoor Air

Indoor Winter Dry-Bulb 68 F.

Heating Source

(1) Warm Air Supply Air Temp. 110 F.

(2) Hydronic Hot Water Temp. drop _____ F.

Ventilation Air

Type of Input: (1) Cfm/sq ft
(2) Total Cfm
(3) % of supply air
(4) Cfm/Person

Ventilation Air 15

Heating Safety Factor 6 %

MISCELLANEOUS SYSTEM DATA

Return Air

Flow through ceiling plenum Y or N
% of Ventilation Air Exhausted from Space _____ %
% of Lighting Load to plenum 0 % (30%)
% of Roof Load to plenum 0 % (70%)

Supply Fan Data

Supply Fan Total Static Pressure .25 in.

Supply Fan Type (1) Draw-thru
(2) Blow-thru

Coil Bypass Factor .05

Hours of System Operation 12 or 16 or 24

Spaces within Zone

Space Name	Mult.	Space Name	Mult.	Space Name	Mult.
1 <u>Tower 2</u>		18		35	
2		19		36	
3		20		37	
4		21		38	
5		22		39	
6		23		40	
7		24		41	
8		25		42	
9		26		43	
10		27		44	
11		28		45	
12		29		46	
13		30		47	
14		31		48	
15		32		49	
16		33		50	
17		34			

COMPLEX SPACE INPUT

Space Name TOWER

Exterior Wall Information

Number of Wall Types -- 0 1 2 3

Type	Height (lb/sq ft)	Color	U-value
1 (L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	.10
2 (L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	.59
3 (L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	

WALL
DOOR

Wall Area (sq ft)			
Exposure	Type 1	Type 2	Type 3
North East	70	18	
East			
South East	55	0	
South			
South West	46	0	
West			
North West	55	0	
North			

Roof Information

Number of Roof Types -- 0 1 2 3

Type	Shade all day	Height	Color	U-value	Area
1 (L-201b H-801b M-1401b)	Yes	(L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)	.10	114
2	No	(L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)		
3	No	(L-201b H-801b M-1401b)	(L-201b H-801b M-1401b)		

Glass Information

Number of Glass Types -- 0 1 2 3

Type	U-value	Building Height (lb/sq ft)	Shade Factor	Internal Shades
1	.55	L-301b H-1001b M-1501b	L-.55 H-.85 D-.75 (1.0)	Yes (80)
2	.55	L-301b H-1001b M-1501b	L-.55 H-.85 D-.75 (1.5)	Yes (80)
3	.55	L-301b H-1001b M-1501b	L-.55 H-.85 D-.75 (1.0)	Yes (80)

Shading Information

Shade Type	Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Extension (in)	Fin Separation (in)	Extension (in)
1	3.36	2.6	0	12"	48"	0	0
2	5	5	0	12"	48"	0	0
3	3.35	5	0	12"	48"	0	0

Glass Area

Exposure	Type 1			Type 2			Type 3		
	Area	Shade		Area	Shade		Area	Shade	
North East	6	0 1 2 3		6	0 1 2 3		0	0 1 2 3	
East		0 1 2 3			0 1 2 3			0 1 2 3	
South East	0	0 1 2 3		25	0 1 2 3		16	0 1 2 3	
South		0 1 2 3			0 1 2 3			0 1 2 3	
South West	0	0 1 2 3		50	0 1 2 3		0	0 1 2 3	
West		0 1 2 3			0 1 2 3			0 1 2 3	
North West	0	0 1 2 3		25	0 1 2 3		16	0 1 2 3	
North		0 1 2 3			0 1 2 3			0 1 2 3	
Horiz.		0 1 2 3			0 1 2 3			0 1 2 3	

- Floor Area : 114 (sq ft)
- Sq ft/Person : or Total people 3 schedule : 4
- Activity Level : 1-seated at rest Office work 3-sedentary work
4-light work 5-heavy work 6-other sens. 1st.
- Lighting (watts/sq ft): 160 or (total watts) schedule : 3
- Other Electric 100 (watts/sq ft) or (total watts) schedule 3
- Fluorescent Lights Y or N Ballast Mult. 1.25
- Miscellaneous sensible: 6000 schedule no. 3
- Miscellaneous latent: 0 schedule no.

Partitions, Ceilings, and Floors

	Area (sq ft)	U-value	Cooling <--- Delta T-->Heating
Walls			
Ceiling			
Floors	114	.11	9 67

Cooling season infiltration .1 Heating season infiltration .1

Slab Floor Area 0 sq ft Perimeter ft Depth below ground ft

ZONE INPUT SHEET

ZONE NAME STD BLDG 2

JOB NAME TRTS / FT. DEVENS

COOLING SYSTEM DATA

Indoor Air

Indoor Summer Dry-Bulb 88 F.

(Enter Relative Humidity or Summer Wet-bulb
the other is calculated by program)

Indoor Summer Wet-Bulb _____ F.

OR

Relative Humidity 60 %

Supply Air

Type of Input : (1) Cfm/sq ft
(2) Total Cfm
(3) Temperature

Supply Air (cooling) _____

Ventilation Air

Type of Input: (1) Cfm/sq ft
(2) Total Cfm
(3) % of supply air
(4) Cfm/Person

Ventilation Air _____

Cooling Safety Factor _____ %

HEATING SYSTEM DATA

Indoor Air

Indoor Winter Dry-Bulb 68 F.

Heating Source

(1) Warm Air Supply Air Temp. 110 F.

(2) Hydronic Hot Water Temp. drop _____ F.

Ventilation Air

Type of Input: (1) Cfm/sq ft
(2) Total Cfm
(3) % of supply air
(4) Cfm/Person

Ventilation Air 6

Heating Safety Factor _____ %

MISCELLANEOUS SYSTEM DATA

Return Air

Flow through ceiling plenum Y or N
% of Ventilation Air Exhausted from Space _____ %
% of Lighting Load to plenum _____ % (30%)
% of Roof Load to plenum _____ % (70%)

Supply Fan Data

Supply Fan Total Static Pressure _____ in.

Supply Fan Type (1) Draw-thru
(2) Blow-thru

Coil Bypass Factor _____

Hours of System Operation 12 or 16 or 24

Spaces within Zone

Space Name	Mult.	Space Name	Mult.	Space Name	Mult.
1		18		35	
2		19		36	
3		20		37	
4		21		38	
5		22		39	
6		23		40	
7		24		41	
8		25		42	
9		26		43	
10		27		44	
11		28		45	
12		29		46	
13		30		47	
14		31		48	
15		32		49	
16		33		50	
17		34			

COMPLEX SPACE INPUT

Space Name INSTRUCTION

Exterior Wall Information

Number of Wall Types -- 0 1 2 3

Type	Weight (lb/sq ft)	Color	U-value
1 L-201b M-801b H-1401b ()	L M D	.58	
2 L-201b M-801b H-1401b ()	L M D	.59	
3 L-201b M-801b H-1401b ()	L M D		

Wall
door

Exposure	Type 1	Type 2	Type 3
North East			
East	352	0	
South East			
South	196	21	
South West			
West	352	0	
North West			
North	196	21	

Roof Information

Number of Roof Types -- 0 1 2 3

Type	Shade all day	Weight	color	U-value	Area
1	No Yes	L-201b M-401b H-801b ()	L M D	.58	0.5
2	No Yes	L-201b M-401b H-801b ()	L M D		
3	No Yes	L-201b M-401b H-801b ()	L M D		

Glass Information

Number of Glass Types -- 0 1 2 3

Type	U-value	Building Weight (lb/sq ft)	Shade Factor	Internal Shades
1	.55	L-301b M-1001b H-1801b ()	L-.58 M-.68 D-.78 (/)	Yes (No)
2		L-301b M-1001b H-1801b ()	L-.58 M-.68 D-.78 ()	Yes No
3		L-301b M-1001b H-1801b ()	L-.58 M-.68 D-.78 ()	Yes No

Shading Information

Shade Type	Window Height (feet)	Width	Reveal Depth (in)	Overhang Height (in)	Extension	Fins Separation (in)	Extension
1							
2							
3							

Glass Area

Exposure	Type 1				Type 2				Type 3						
	Area	Shade			Area	Shade			Area	Shade					
North East		0	1	2	3		0	1	2	3		0	1	2	3
East	48	0	1	2	3		0	1	2	3		0	1	2	3
South East		0	1	2	3		0	1	2	3		0	1	2	3
South		0	1	2	3		0	1	2	3		0	1	2	3
South West		0	1	2	3		0	1	2	3		0	1	2	3
West	48	0	1	2	3		0	1	2	3		0	1	2	3
North West		0	1	2	3		0	1	2	3		0	1	2	3
North		0	1	2	3		0	1	2	3		0	1	2	3
Horiz.		0	1	2	3		0	1	2	3		0	1	2	3

- 1) Floor Area : 500 (sq ft)
- 2) Sq ft/Person : _____ or Total people _____ schedule : _____
- 3) Activity Level : 1-seated at rest 2-office work 3-sedentary work
4-light work 5-heavy work 6-other sens. _____ 1st. _____
- 4) Lighting (watts/sq ft) : _____ or (total watts) schedule : _____
- 5) Other Electric _____ (watts/sq ft) or (total watts) schedule _____
- 6) Fluorescent Lights Y or N Ballast Mult. _____
- 7) Miscellaneous sensible : _____ schedule no. _____
- 8) Miscellaneous latent : _____ schedule no. _____

Partitions, Ceilings, and Floors

	Area (sq ft)	U-value	Cooling <--- Delta T---> Heating
Walls			
Ceiling			
Floors			

Cooling season infiltration .1 Heating season infiltration 475

Slab Floor Area 500 sq ft Perimeter 120 ft Depth below ground 0 ft

FORT DEVENS
Massachu.

Latitude: 42 deg N Summer Design DB: 89.0 F Daily Range : 24.0 F
Elevation: 268 ft Summer Design WB: 73.0 F Winter Design DB: 1.0 F
Solar Haze Factor: 0 %

ft	January	February	March	April	May	June
000	27.9/ 25.8	31.4/ 30.4	42.4/ 41.4	52.4/ 51.4	61.8/ 60.8	68.4/ 66.2
100	25.8/ 24.8	29.4/ 28.4	40.4/ 39.4	50.4/ 49.4	59.8/ 58.8	66.4/ 65.4
200	24.8/ 23.8	28.4/ 27.4	39.4/ 38.4	49.4/ 48.4	58.8/ 57.8	65.4/ 64.4
300	23.8/ 22.8	27.4/ 26.4	38.4/ 37.4	48.4/ 47.4	57.8/ 56.8	64.4/ 63.4
400	23.0/ 22.0	26.6/ 25.6	37.6/ 36.6	47.6/ 46.6	57.0/ 56.0	63.6/ 62.6
500	24.0/ 23.0	27.6/ 26.6	38.6/ 37.6	48.6/ 47.6	58.0/ 57.0	64.6/ 63.6
600	25.8/ 24.8	29.4/ 28.4	40.4/ 39.4	50.4/ 49.4	59.8/ 58.8	66.4/ 65.4
700	27.8/ 26.8	31.4/ 30.4	42.4/ 41.4	52.4/ 51.4	61.8/ 60.8	68.4/ 67.0
800	29.8/ 28.8	33.4/ 32.4	44.4/ 43.4	54.4/ 53.4	63.8/ 62.8	70.4/ 67.0
900	32.6/ 31.6	36.2/ 35.2	47.2/ 46.2	57.2/ 56.2	66.6/ 65.0	73.2/ 68.0
1000	35.4/ 34.4	39.0/ 38.0	50.0/ 49.0	60.0/ 59.0	69.4/ 65.0	76.0/ 68.0
1100	37.4/ 36.4	41.0/ 40.0	52.0/ 51.0	62.0/ 61.0	71.4/ 66.0	78.0/ 69.0
1200	40.4/ 39.4	44.0/ 43.0	55.0/ 54.0	65.0/ 62.0	74.4/ 67.0	81.0/ 70.0
1300	42.4/ 41.4	46.0/ 45.0	57.0/ 56.0	67.0/ 63.0	76.4/ 68.0	83.0/ 71.0
1400	44.4/ 43.4	48.0/ 47.0	59.0/ 58.0	69.0/ 63.0	78.4/ 68.0	85.0/ 71.0
1500	45.4/ 44.4	49.0/ 48.0	60.0/ 59.0	70.0/ 63.0	79.4/ 68.0	86.0/ 71.0
1600	46.4/ 45.4	49.0/ 47.0	59.0/ 58.0	69.0/ 63.0	78.4/ 68.0	85.0/ 71.0
1700	43.4/ 42.4	47.0/ 46.0	58.0/ 57.0	68.0/ 63.0	77.4/ 68.0	84.0/ 71.0
1800	42.4/ 41.4	46.0/ 45.0	57.0/ 56.0	67.0/ 62.0	76.4/ 67.0	83.0/ 70.0
1900	39.6/ 38.6	43.2/ 42.2	54.2/ 53.2	64.2/ 62.0	73.6/ 67.0	80.2/ 70.0
2000	37.6/ 36.6	41.2/ 40.2	52.2/ 51.2	62.2/ 61.0	71.6/ 66.0	78.2/ 69.0
2100	34.8/ 33.8	38.4/ 37.4	49.4/ 48.4	59.4/ 58.4	68.8/ 66.0	75.4/ 69.0
2200	32.8/ 31.8	36.4/ 35.4	47.4/ 46.4	57.4/ 56.4	66.8/ 65.0	73.4/ 68.0
2300	29.8/ 28.8	33.4/ 32.4	44.4/ 43.4	54.4/ 53.4	63.8/ 62.8	70.4/ 67.2
2400	27.4/ 26.4	31.0/ 30.0	42.0/ 41.0	52.0/ 51.0	61.4/ 60.4	68.0/ 66.0
2500	25.4/ 24.4	29.0/ 28.0	40.0/ 39.0	50.0/ 49.0	59.4/ 58.4	66.0/ 64.0
2600	23.4/ 22.4	27.0/ 26.0	38.0/ 37.0	48.0/ 47.0	57.4/ 56.4	64.0/ 62.0
2700	21.4/ 20.4	25.0/ 24.0	36.0/ 35.0	46.0/ 45.0	55.4/ 54.4	62.0/ 60.0
2800	19.4/ 18.4	23.0/ 22.0	34.0/ 33.0	44.0/ 43.0	53.4/ 52.4	60.0/ 58.0
2900	17.4/ 16.4	21.0/ 20.0	32.0/ 31.0	42.0/ 41.0	51.4/ 50.4	58.0/ 56.0
3000	15.4/ 14.4	19.0/ 18.0	30.0/ 29.0	40.0/ 39.0	49.4/ 48.4	56.0/ 54.0
3100	13.4/ 12.4	17.0/ 16.0	28.0/ 27.0	38.0/ 37.0	47.4/ 46.4	54.0/ 52.0
3200	11.4/ 10.4	15.0/ 14.0	26.0/ 25.0	36.0/ 35.0	45.4/ 44.4	52.0/ 50.0
3300	9.4/ 8.4	13.0/ 12.0	24.0/ 23.0	34.0/ 33.0	43.4/ 42.4	50.0/ 48.0
3400	7.4/ 6.4	11.0/ 10.0	22.0/ 21.0	32.0/ 31.0	41.4/ 40.4	48.0/ 46.0
3500	5.4/ 4.4	9.0/ 8.0	20.0/ 19.0	30.0/ 29.0	39.4/ 38.4	46.0/ 44.0
3600	3.4/ 2.4	7.0/ 6.0	18.0/ 17.0	28.0/ 27.0	37.4/ 36.4	44.0/ 42.0
3700	1.4/ 0.4	5.0/ 4.0	16.0/ 15.0	26.0/ 25.0	35.4/ 34.4	42.0/ 40.0
3800	0.4/ -0.4	3.0/ 2.0	14.0/ 13.0	24.0/ 23.0	33.4/ 32.4	40.0/ 38.0
3900	-0.4/ -1.4	1.0/ 0.0	12.0/ 11.0	22.0/ 21.0	31.4/ 30.4	38.0/ 36.0
4000	-1.4/ -2.4	-0.4/ -1.4	10.0/ 9.0	20.0/ 19.0	29.4/ 28.4	36.0/ 34.0
4100	-2.4/ -3.4	-1.4/ -2.4	8.0/ 7.0	18.0/ 17.0	27.4/ 26.4	34.0/ 32.0
4200	-3.4/ -4.4	-2.4/ -3.4	6.0/ 5.0	16.0/ 15.0	25.4/ 24.4	32.0/ 30.0
4300	-4.4/ -5.4	-3.4/ -4.4	4.0/ 3.0	14.0/ 13.0	23.4/ 22.4	30.0/ 28.0
4400	-5.4/ -6.4	-4.4/ -5.4	2.0/ 1.0	12.0/ 11.0	21.4/ 20.4	28.0/ 26.0
4500	-6.4/ -7.4	-5.4/ -6.4	0.0/ -0.4	10.0/ 9.0	19.4/ 18.4	26.0/ 24.0
4600	-7.4/ -8.4	-6.4/ -7.4	-0.4/ -1.4	8.0/ 7.0	17.4/ 16.4	24.0/ 22.0
4700	-8.4/ -9.4	-7.4/ -8.4	-1.4/ -2.4	6.0/ 5.0	15.4/ 14.4	22.0/ 20.0
4800	-9.4/ -10.4	-8.4/ -9.4	-2.4/ -3.4	4.0/ 3.0	13.4/ 12.4	20.0/ 18.0
4900	-10.4/ -11.4	-9.4/ -10.4	-3.4/ -4.4	2.0/ 1.0	11.4/ 10.4	18.0/ 16.0
5000	-11.4/ -12.4	-10.4/ -11.4	-4.4/ -5.4	0.0/ -0.4	9.4/ 8.4	16.0/ 14.0
5100	-12.4/ -13.4	-11.4/ -12.4	-5.4/ -6.4	-0.4/ -1.4	7.4/ 6.4	14.0/ 12.0
5200	-13.4/ -14.4	-12.4/ -13.4	-6.4/ -7.4	-1.4/ -2.4	5.4/ 4.4	12.0/ 10.0
5300	-14.4/ -15.4	-13.4/ -14.4	-7.4/ -8.4	-2.4/ -3.4	3.4/ 2.4	10.0/ 8.0
5400	-15.4/ -16.4	-14.4/ -15.4	-8.4/ -9.4	-3.4/ -4.4	1.4/ 0.4	8.0/ 6.0
5500	-16.4/ -17.4	-15.4/ -16.4	-9.4/ -10.4	-4.4/ -5.4	-0.4/ -1.4	6.0/ 4.0
5600	-17.4/ -18.4	-16.4/ -17.4	-10.4/ -11.4	-5.4/ -6.4	-1.4/ -2.4	4.0/ 2.0
5700	-18.4/ -19.4	-17.4/ -18.4	-11.4/ -12.4	-6.4/ -7.4	-2.4/ -3.4	2.0/ 0.0
5800	-19.4/ -20.4	-18.4/ -19.4	-12.4/ -13.4	-7.4/ -8.4	-3.4/ -4.4	0.0/ -0.4
5900	-20.4/ -21.4	-19.4/ -20.4	-13.4/ -14.4	-8.4/ -9.4	-4.4/ -5.4	-0.4/ -1.4
6000	-21.4/ -22.4	-20.4/ -21.4	-14.4/ -15.4	-9.4/ -10.4	-5.4/ -6.4	-1.4/ -2.4
6100	-22.4/ -23.4	-21.4/ -22.4	-15.4/ -16.4	-10.4/ -11.4	-6.4/ -7.4	-2.4/ -3.4
6200	-23.4/ -24.4	-22.4/ -23.4	-16.4/ -17.4	-11.4/ -12.4	-7.4/ -8.4	-3.4/ -4.4
6300	-24.4/ -25.4	-23.4/ -24.4	-17.4/ -18.4	-12.4/ -13.4	-8.4/ -9.4	-4.4/ -5.4
6400	-25.4/ -26.4	-24.4/ -25.4	-18.4/ -19.4	-13.4/ -14.4	-9.4/ -10.4	-5.4/ -6.4
6500	-26.4/ -27.4	-25.4/ -26.4	-19.4/ -20.4	-14.4/ -15.4	-10.4/ -11.4	-6.4/ -7.4
6600	-27.4/ -28.4	-26.4/ -27.4	-20.4/ -21.4	-15.4/ -16.4	-11.4/ -12.4	-7.4/ -8.4
6700	-28.4/ -29.4	-27.4/ -28.4	-21.4/ -22.4	-16.4/ -17.4	-12.4/ -13.4	-8.4/ -9.4
6800	-29.4/ -30.4	-28.4/ -29.4	-22.4/ -23.4	-17.4/ -18.4	-13.4/ -14.4	-9.4/ -10.4
6900	-30.4/ -31.4	-29.4/ -30.4	-23.4/ -24.4	-18.4/ -19.4	-14.4/ -15.4	-10.4/ -11.4
7000	-31.4/ -32.4	-30.4/ -31.4	-24.4/ -25.4	-19.4/ -20.4	-15.4/ -16.4	-11.4/ -12.4
7100	-32.4/ -33.4	-31.4/ -32.4	-25.4/ -26.4	-20.4/ -21.4	-16.4/ -17.4	-12.4/ -13.4
7200	-33.4/ -34.4	-32.4/ -33.4	-26.4/ -27.4	-21.4/ -22.4	-17.4/ -18.4	-13.4/ -14.4
7300	-34.4/ -35.4	-33.4/ -34.4	-27.4/ -28.4	-22.4/ -23.4	-18.4/ -19.4	-14.4/ -15.4
7400	-35.4/ -36.4	-34.4/ -35.4	-28.4/ -29.4	-23.4/ -24.4	-19.4/ -20.4	-15.4/ -16.4
7500	-36.4/ -37.4	-35.4/ -36.4	-29.4/ -30.4	-24.4/ -25.4	-20.4/ -21.4	-16.4/ -17.4
7600	-37.4/ -38.4	-36.4/ -37.4	-30.4/ -31.4	-25.4/ -26.4	-21.4/ -22.4	-17.4/ -18.4
7700	-38.4/ -39.4	-37.4/ -38.4	-31.4/ -32.4	-26.4/ -27.4	-22.4/ -23.4	-18.4/ -19.4
7800	-39.4/ -40.4	-38.4/ -39.4	-32.4/ -33.4	-27.4/ -28.4	-23.4/ -24.4	-19.4/ -20.4
7900	-40.4/ -41.4	-39.4/ -40.4	-33.4/ -34.4	-28.4/ -29.4	-24.4/ -25.4	-20.4/ -21.4
8000	-41.4/ -42.4	-40.4/ -41.4	-34.4/ -35.4	-29.4/ -30.4	-25.4/ -26.4	-21.4/ -22.4
8100	-42.4/ -43.4	-41.4/ -42.4	-35.4/ -36.4	-30.4/ -31.4	-26.4/ -27.4	-22.4/ -23.4
8200	-43.4/ -44.4	-42.4/ -43.4	-36.4/ -37.4	-31.4/ -32.4	-27.4/ -28.4	-23.4/ -24.4
8300	-44.4/ -45.4	-43.4/ -44.4	-37.4/ -38.4	-32.4/ -33.4	-28.4/ -29.4	-24.4/ -25.4
8400	-45.4/ -46.4	-44.4/ -45.4	-38.4/ -39.4	-33.4/ -34.4	-29.4/ -30.4	-25.4/ -26.4
8500	-46.4/ -47.4	-45.4/ -46.4	-39.4/ -40.4	-34.4/ -35.4	-30.4/ -31.4	-26.4/ -27.4
8600	-47.4/ -48.4	-46.4/ -47.4	-40.4/ -41.4	-35.4/ -36.4	-31.4/ -32.4	-27.4/ -28.4
8700	-48.4/ -49.4	-47.4/ -48.4	-41.4/ -42.4	-36.4/ -37.4	-32.4/ -33.4	-28.4/ -29.4
8800	-49.4/ -50.4	-48.4/ -49.4	-42.4/ -43.4	-37.4/ -38.4	-33.4/ -34.4	-29.4/ -30.4
8900	-50.4/ -51.4	-49.4/ -50.4	-43.4/ -44.4	-38.4/ -39.4	-34.4/ -35.4	-30.4/ -31.4
9000	-51.4/ -52.4	-50.4/ -51.4	-44.4/ -45.4	-39.4/ -40.4	-35.4/ -36.4	-31.4/ -32.4
9100	-52.4/ -53.4	-51.4/ -52.4	-45.4/ -46.4	-40.4/ -41.4	-36.4/ -37.4	-32.4/ -33.4
9200	-53.4/ -54.4	-52.4/ -53.4	-46.4/ -47.4	-41.4/ -42.4	-37.4/ -38.4	-33.4/ -34.4
9300	-54.4/ -55.4	-53.4/ -54.4	-47.4/ -48.4	-42.4/ -43.4	-38.4/ -39.4	-34.4/ -35.4
9400	-55.4/ -56.4	-54.4/ -55.4	-48.4/ -49.4	-43.4/ -44.4	-39.4/ -40.4	-35.4/ -36.4
9500	-56.4/ -57.4	-55.4/ -56.4	-49.4/ -50.4	-44.4/ -45.4	-40.4/ -41.4	-36.4/ -37.4
9600	-57.4/ -58.4	-56.4/ -57.4	-50.4/ -51.4	-45.4/ -46.4	-41.4/ -42.4	-37.4/ -38.4
9700	-58.4/ -59.4	-57.4/ -58.4	-51.4/ -52.4	-46.4/ -47.4	-42.4/ -43.4	-38.4/ -39.4
9800	-59.4/ -60.4	-58.4/ -59.4	-52.4/ -53.4	-47.4/ -48.4	-43.4/ -44.4	-39.4/ -40.4
9900	-60.4/ -61.4	-59.4/ -60.4	-53.4/ -54.4	-48.4/ -49.4	-44.4/ -45.4	-40.4/ -41.4
10000	-61.4/ -62.4	-60.4/ -61.4	-54.4/ -55.4	-49.4/ -50.4	-45.4/ -46.4	-41.4/ -42.4

ZONE INPUT PRINTOUT

CONTROL TOWER

JOB NAME: RETS/FT DEVENS

DATE PREPARED : 04-09-1986

*****60501852.1*****

Daily hours of system operation = 24

Cooling Coil Bypass Factor = 0.050

Indoor Air Data:

Cooling Season - Dry Bulb	=	80.0 F
Wet Bulb	=	66.6 F
Rel. Humidity	=	50.0 %
Heating Season - Dry Bulb	=	68.0 F

Supply Data:

Cooling Season - Supply Air Temperature	=	57.0 F
Heating Season - Supply Air Temperature	=	110.0 F

Supply Fan Data:

Estimated fan static pressure	=	0.250 in.
Fan type	=	1) Draw-thru

Ventilation Air Data:

Cooling Season - Cfm/person	=	15.0 Cfm/person
Heating Season - Cfm/person	=	15.0 Cfm/person

Plenum Data:

Does return air flow through plenum	?	N
-------------------------------------	---	---

Safety Factors:

Cooling	=	5 %
Heating warm-up	=	5 %

LIST OF SPACES INCLUDED IN ZONE

Name	Mult	Name	Mult
1 (C) TOWER	x 1		

COMPLEX SPACE INPUT PRINTOUT

TOWER

DATE PREPARED : 04-09-1986

60501852.1

WALL TYPE	WEIGHT (lb/sqft)	EXTERNAL COLOR	U-VALUE (Btu/hr/sqft/F)
1	L	M	0.100
2	L	M	0.590
3	-	-	-

ROOF TYPE	SHADED ALL DAY?	WEIGHT (lb/sqft)	EXTERNAL COLOR	U-VALUE (Btu/hr/sqft/F)	AREA (sqft)
1	N	L	M	0.100	114.00
2	-	-	-	-	-
3	-	-	-	-	-

GLASS TYPE	U-VALUE (Btu/hr/sqft/F)	WEIGHT (lb/sqft)	GLASS FACTOR	INTERNAL SHADES?
1	0.55	L	1.00	N
2	0.55	L	1.00	N
3	0.55	L	1.00	N

SHADE TYPE	<-----WINDOW----->		REVEAL	<-----OVERHANG----->		<-----FINS----->	
	HEIGHT	WIDTH	DEPTH	HEIGHT	EXTEN.	SEPAR.	EXTEN.
1	3.3 ft	2.5 ft	0.0 in	12.0 in	48.0 in	0.0 in	0.0 in
2	5.0 ft	5.0 ft	0.0 in	12.0 in	48.0 in	0.0 in	0.0 in
3	3.3 ft	5.0 ft	0.0 in	12.0 in	48.0 in	0.0 in	0.0 in

PARTITIONS, CEILINGS, FLOORS ADJ TO UNCONDITIONED SPACE	AREA (sqft)	U-VALUE (Btu/hr/sqft/F)	-----DELTA T-----	COOLING	HEATING
Walls	0	0.080		0.0 F	0.0 F
Ceilings	0	0.080		0.0 F	0.0 F
Floors	114	0.110		9.0 F	67.0 F

SLAB FLOOR

1. Area	=	0.00 sqft
2. Perimeter	=	0.0 ft
3. Depth	=	0.0 ft

INFILTRATION AND INTERNAL LOAD DATA:

1. TOTAL FLOOR AREA	=	114.00 sqft	
2. COOLING SEASON INFILTRATION AIR	=	0.10 Cfm/sqft	11 Cfm Total
3. HEATING SEASON INFILTRATION AIR	=	0.10 Cfm/sqft	11 Cfm Total
4. PEOPLE	33 sqft/person FOR TOTAL	3 PEOPLE	
Schedule No : 4			
Activity Level 2=Office Worker / Retail Store			
Sensible : 245 Btu/hr/per		Latent : 205 Btu/hr/per	
5. LIGHTING	1.40 Watts/sq ft	TOTAL 160 Watts	
Schedule No : 3			
Lights are Fluorescent			
Ballast Multiplier : 1.25			
6. OTHER ELEC.	1.75 Watts/sq ft	TOTAL 200 Watts	
7. MISC.	Sensible = 6,000 Btu/hr	Schedule No : 3	
	Latent = 0 Btu/hr	Schedule No : 0	

INPUT DATA FOR TOWER

WALL AREAS (sqft) BY TYPE AND EXPOSURE

EXPOSURE	TYPE 1	TYPE 2	TOTAL
W	70.00	18.00	88.00
E	0.00	0.00	0.00
S	55.00	0.00	55.00
N	0.00	0.00	0.00
SW	45.00	0.00	45.00
SE	0.00	0.00	0.00
NW	55.00	0.00	55.00
NE	0.00	0.00	0.00
TOTAL	226	18	244

GLASS AREAS AND SHADING TYPES BY GLASS TYPE AND EXPOSURE

EXPOSURE	(--GLASS TYPE 1 --)		(--GLASS TYPE 2 --)		(--GLASS TYPE 3 --)		TOTAL AREA (sqft)
	AREA (sqft)	SHADE TYPE	AREA (sqft)	SHADE TYPE	AREA (sqft)	SHADE TYPE	
W	0	1	0	0	0	0	8
E	0	0	0	0	0	0	0
S	0	0	25	2	16	3	41
N	0	0	0	0	0	0	0
SW	0	0	50	2	0	0	50
SE	0	0	0	0	0	0	0
NW	0	0	25	2	16	3	41
NE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0
TOTAL	0		100		32		140

SINGLE HOUR LOAD CALCULATION OUTPUT

Aug 17COB : CONTROL TOWER (TOWER)

JOB NAME: RETS/ST DEVENS

DATE PREPARED: 04-09-1986

SITE NAME: FORT DEVENS

Massachu.

60501852.1

OUTDOOR DB/WB: 97.0/ 73.0 F

INDOOR DB: 80.0 F

RH: 49 %

Zone Loads & System Information Summary

pg 1

LOAD COMPONENT SENSIBLE(Btu/hr) LATENT(Btu/hr)

SOLAR GAIN	8,848	0
GLASS TRANSMISSION	539	0
WALL TRANSMISSION	380	0
ROOF TRANSMISSION	296	0
TRANS. LOSS TO UNCOND. SPACE	113	0
LIGHTING (200 W TOTAL)	683	0
OTHER ELEC. (200 W TOTAL)	683	0
PEOPLE (3 PEOPLE TOTAL)	846	708
MISCELLANEOUS LOADS	6,000	0
COOLING INFILTRATION	87	183
COOLING SAFETY LOAD	924	45

SUB-TOTALS	19,399	935
NET VENTILATION LOAD (52 Cfm)	395	1,129
SUPPLY FAN LOAD (BHP= 0.1)	168	0
ROOF LOAD TO PLENUM	0	0
LIGHTING LOAD TO PLENUM	0	0

TOTAL COOLING LOADS	19,962	2,065
TOTAL COOLING LOAD =	22,027 Btu/hr	
or 1.84 Ton or	62.1 sqft/ Ton	
ZONE TOTAL FLOOR AREA =	114.00 sqft	
ZONE OVERALL U-FACTOR =	0.244 Btu/hr/sqft/F	

Transmission and Solar Gain by Exposure

LOAD COMPONENT AREA (sqft) TRANSMISSION (Btu/hr) SOLAR GAIN (Btu/hr)

GLASS LOADS: NE	8	31	114
E	0	0	0
SE	41	158	1,290
S	0	0	0
SW	50	193	4,924
W	0	0	0
NW	41	158	2,520
N	0	0	0
H	0	0	0
WALL LOADS: NE	88	106	-
E	0	0	-
SE	55	39	-
S	0	0	-
SW	46	143	-
W	0	0	-
NW	55	94	-
N	0	0	-

SINGLE HOUR LOAD CALCULATION OUTPUT

AUG 1700H : CONTROL TOWER (TOWER)

JOB NAME: RETS/FT DEVENS DATE PREPARED: 04-09-1986
 SITE NAME: FORT DEVENS Massachu. 60501852.1
 OUTDOOR DB/WB: 87.0/ 73.0 F INDOOR DB: 80.0 F RH: 49 %

Coil Selection Parameters

pg 2

COIL ENTERING AIR TEMP. (DB/WB)	=	80.5/ 65.5 deg F
COIL LEAVING AIR TEMP. (DB/WB)	=	56.8/ 56.1 deg F
COIL SENSIBLE LOAD	=	19,962 Btu/hr
COIL TOTAL LOAD	=	22,027 Btu/hr
COOLING SUPPLY AIR TEMPERATURE	=	57.0 deg F
TOTAL COOLING Cfm	=	774 Cfm
COOLING Cfm/sqft	=	6.79 Cfm/sqft
RESULTING ROOM REL. HUMIDITY	=	44 %
COIL BYPASS FACTOR	=	0.050

HEATING LOAD CALCULATION OUTPUT

CONTROL TOWER (TOWER)

JOB NAME: RETS/FT DEVENS

DATE PREPARED: 04-09-1986

SITE NAME: FORT DEVENS

Massachu.

60501852.1

WINTER DESIGN DRY BULB: 1.0 F

INDOOR DB: 68.0 F

HEATING LOAD SUMMARY

Note: Heating load is computed at winter design condition.

LOAD COMPONENT	LOAD (Btu/hr)
WALL TRANSMISSION	2,226
ROOF TRANSMISSION	764
GLASS TRANSMISSION	5,159
TRANSMISSION LOSS TO UNCOND. SPACES	840
INFILTRATION LOSS	832
SLAB FLOOR	0
HEATING SAFETY Btu/hr	491
SUB-TOTAL	10,312
NET VENTILATION LOSS	3,782
TOTAL HEATING LOAD	14,094
HEATING SUPPLY CFM	223 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	52 CFM
HEATING SEASON ROOM DRY BULB TEMP.	68.0 deg F

5KW
elec

ZONE INPUT PRINTOUT
STANDARD BLDG NO 2

JOB NAME: RETS/FT DEVENS DATE PREPARED : 04-09-1986

*****60501852.1*****

Daily hours of system operation = 24
Cooling Coil Bypass Factor = 0.050

Indoor Air Data:

Cooling Season - Dry Bulb = 80.0 F
Wet Bulb = 66.6 F
Rel. Humidity = 50.0 %
Heating Season - Dry Bulb = 68.0 F

Supply Data:

Cooling Season - Supply Air Temperature = 57.0 F
Heating Season - Supply Air Temperature = 110.0 F

Supply Fan Data:

Estimated fan static pressure = 0.250 in.
Fan type = 1) Draw-thru

Ventilation Air Data:

Cooling Season - Cfm/person = 15.0 Cfm/person
Heating Season - Cfm/person = 15.0 Cfm/person

Plenum Data:

Does return air flow through plenum ? N

Safety Factors:

Cooling = 5 %
Heating Warm-up = 5 %

LIST OF SPACES INCLUDED IN ZONE

Name	Mult	Name	Mult
1 (C) INSTRUCTION	x 1		

COMPLEX SPACE INPUT PRINTOUT

INSTRUCTION

DATE PREPARED : 04-09-1986

60501852.1

WALL TYPE	WEIGHT (lb/sqft)	EXTERNAL COLOR	U-VALUE (Btu/hr/sqft/F)
1	L	M	0.080
2	L	M	0.590
3	-	-	-

ROOF TYPE	SHADED ALL DAY?	WEIGHT (lb/sqft)	EXTERNAL COLOR	U-VALUE (Btu/hr/sqft/F)	AREA (sqft)
1	N	L	M	0.050	808.00
2	-	-	-	-	-
3	-	-	-	-	-

GLASS TYPE	U-VALUE (Btu/hr/sqft/F)	WEIGHT (lb/sqft)	GLASS FACTOR	INTERNAL SHADES?
1	0.55	L	1.00	N
2	-	-	-	-
3	-	-	-	-

SHADE TYPE	<-----WINDOW----->		REVEAL DEPTH	<-----OVERHANG----->		<-----FINS----->	
	HEIGHT	WIDTH		HEIGHT	EXTEN.	SEPAR.	EXTEN.
1	3.3 ft	2.5 ft	0.0 in	0.0 in	0.0 in	0.0 in	0.0 in
2	5.0 ft	5.0 ft	0.0 in	0.0 in	0.0 in	0.0 in	0.0 in
3	3.3 ft	5.0 ft	0.0 in	0.0 in	0.0 in	0.0 in	0.0 in

PARTITIONS, CEILINGS, FLOORS ADJ TO UNCONDITIONED SPACE	AREA (sqft)	U-VALUE (Btu/hr/sqft/F)	-----DELTA T----- COOLING	HEATING
Walls	0	0.080	0.0 F	0.0 F
Ceilings	0	0.080	0.0 F	0.0 F
Floors	0	0.110	0.0 F	0.0 F

SLAB FLOOR

1. Area = 800.00 sqft
 2. Perimeter = 120.0 ft
 3. Depth = 0.0 ft

INFILTRATION AND INTERNAL LOAD DATA:

1. TOTAL FLOOR AREA = 800.00 sqft
 2. COOLING SEASON INFILTRATION AIR = 0.10 Cfm/sqft 80 Cfm Total
 3. HEATING SEASON INFILTRATION AIR = 0.10 Cfm/sqft 80 Cfm Total
 4. PEOPLE 33 sqft/person FOR TOTAL 24 PEOPLE
 Schedule No : 4
 Activity Level 2=Office Worker / Retail Store
 Sensible : 245 Btu/hr/per Latent : 205 Btu/hr/per
 5. LIGHTING 1.40 Watts/sq ft TOTAL 1,123 Watts
 Schedule No : 3
 Lights are Fluorescent
 Ballast Multiplier : 1.25
 6. OTHER ELEC. 1.75 Watts/sq ft TOTAL 1,404 Watts
 7. MISC. Sensible = 0 Btu/hr Schedule No : 0
 Latent = 0 Btu/hr Schedule No : 0

INPUT DATA FOR INSTRUCTION

WALL AREAS (sqft) BY TYPE AND EXPOSURE

EXPOSURE	TYPE 1	TYPE 2	TOTAL
NE	0.00	0.00	0.00
E	352.00	0.00	352.00
SE	0.00	0.00	0.00
S	196.00	21.00	217.00
SW	0.00	0.00	0.00
W	352.00	0.00	352.00
NW	0.00	0.00	0.00
N	196.00	21.00	217.00

TOTAL	1,096	42	1,170
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GLASS AREAS AND SHADING TYPES BY GLASS TYPE AND EXPOSURE

(<--GLASS TYPE 1 -->)

EXP.	AREA (sqft)	SHADE TYPE	TOTAL AREA (sqft)
NE	0	0	0
E	48	0	48
SE	0	0	0
S	0	0	0
SW	0	0	0
W	48	0	48
NW	0	0	0
N	0	0	0
C	0	0	0

TOTAL	96		170
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HEATING LOAD CALCULATION OUTPUT
STANDARD BLDG NO 2 (INSTRUCTION)

JOB NAME: RETS/FT DEVENS DATE PREPARED: 04-09-1986
SITE NAME: FORT DEVENS Massachu. 60501852.1
WINTER DESIGN DRY BULB: 1.0 F INDOOR DB: 68.0 F

HEATING LOAD SUMMARY

Note: Heating load is computed at winter design condition.

LOAD COMPONENT	LOAD (Btu/hr)
----------------	---------------

WALL TRANSMISSION	7,535
ROOF TRANSMISSION	2,707
GLASS TRANSMISSION	3,538
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	5,839
SLAB FLOOR	5,324
HEATING SAFETY Btu/hr	1,247

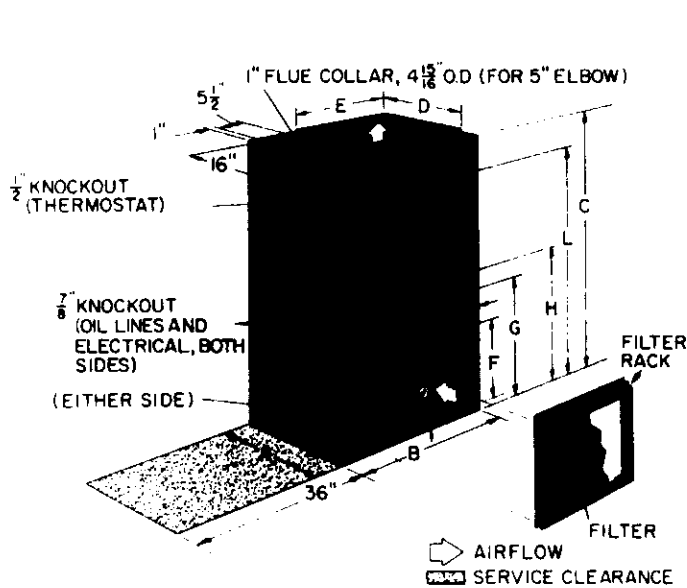
SUB-TOTAL	26,189
NET VENTILATION LOSS	<u>26,541</u>

TOTAL HEATING LOAD	52,731
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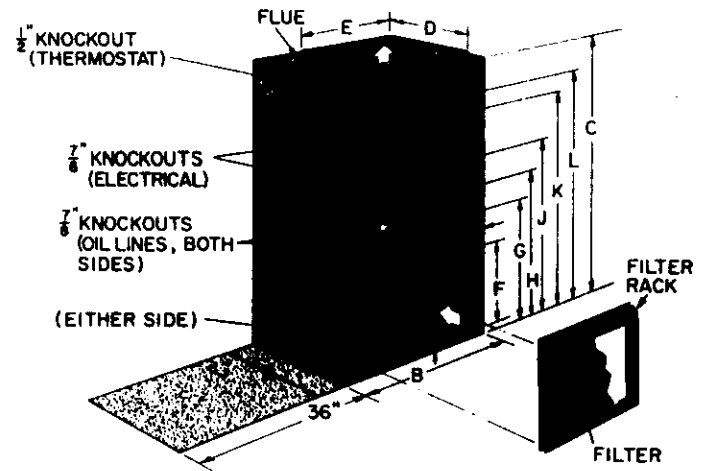
HEATING SUPPLY CFM	567 Cfm
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	364 Cfm
HEATING SEASON ROOM DRY BULB TEMP.	68.0 deg F

Dimensions and physical data

58HU UPFLOW FURNACE (Size 055)



58HU UPFLOW FURNACE (Sizes 085 - 125)



58HU UPFLOW				
055	085	100	125	
100-CA	100-CA	100-CA	100-CA/BA	
205	290	305	350	
19	22	22	24	
28	30-1/2	32-1/2	34-1/2	
47	56	56	60	
17	20	20	22	
17-1/2	20	22	24	
15-1/2	15-1/2	15-1/2	18	
5	5		3-3/4 x 7-1/8*	
21-7/8	21-13/16		24-9/16	
25-7/8	25-13/16		28-9/16	
—	31-1/4		34	
—	37-5/8		40-3/8	
33	45-5/8		48-3/8	
1	1		1	
16x25x1	20x25x1		20x25x1	
70	No. 1 or 2 (Light) Fuel Oil			
55	106	125	156	
	84	99	124	
0.50	0.75	0.90	1.10	
0.50	0.76	0.90	1.12	
2	2	2	2-1/4	
3-11/16	3-1/2	3-1/2	3-3/8	
5	5	5	7	
SS	SS	SS	SS	

SS — Single-Stage

*Six-in. round is equivalent diameter.

†Capacities are based on operation at sea level, with 115-volt, 60-Hz power, 3450-rpm burner motor, no. 2 oil, and pump pressure set at 100 psig. Capacity of each rating is applicable up to 2000 ft of altitude. For each additional 1000 ft of altitude, each rating is reduced by 4%.

†Based on U.S. Government standard tests.

**All nozzles 80 degrees solid spray.

NOTE: Plenum adapters must be field fabricated. Refer to 28 Series literature for plenum dimensions.

Blower-performance data



FURNACE	58HU UPFLOW				
SIZE	055	085	100	125	
SERIES	100CA	100CA	100CA	100BA	100CA
BLOWER Nom Size (in.)	DD 10x8	DD 10x10		DD 10x10	DD 12x9
FAN MOTOR					
Horsepower	1/4	1/3	1/3	1/3	3/4
Max Air* (cfm) at .20-in. wg ESP	940	1320	1300	1330	1620
Max Air* (cfm) at .50-in. wg ESP	1200	1670	1610	1630	2060

FURNACE	58HK DOWNFLOW				
SIZE	085	100		125	
SERIES	100CA	100CA	100DA	100BA	100CA
BLOWER Nom Size (in.)		DD (PSC) 10x10			DD (PSC) 12x9
FAN MOTOR					
Horsepower	1/3	1/3	1/2	1/3	3/4
PPD	—	—	—	—	—
Belt Length	—	—	—	—	—
BMPS† .20-in. wg ESP	—	—	—	—	—
Max Air* (cfm)‡ at .20-in. ESP	910	1230	1130	1220	1440
Max Air* (cfm) at .50-in. wg ESP	1580	1610	1700	1600	2280

- BD — Belt Drive Blower
- BMPS — Blower Motor Pulley Setting (turns open from closed position)
- DD — Direct Drive Blower
- ESP — External Static Pressure (includes filter and cabinet losses)
- PPD — Pulley Pitch Diameter (drive pulley range 2.1 - 2.9 inches)
- PSC — Permanent Split Capacitor Motor

*Filter(s) in place.

†Do not close blower motor pulley beyond setting shown.

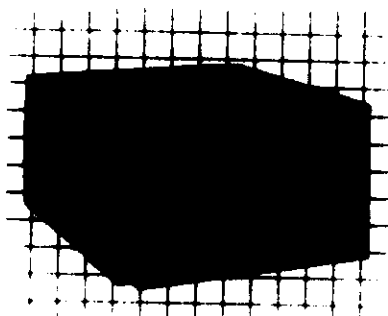
‡When operating furnace in heating mode, static pressure and temperature rise must be within limits specified on U.L. rating plate.

NOTE: Refer to Application Data literature for complete fan performance information.

AIR DELIVERY (Cfm)

58HU FURNACE		MOTOR SPEED	ESP (in. wg)							
Model	Series		.15	.20	.25	.30	.35	.40	.45	.50
			Air Delivery (Cfm)							
055	100CA	High	1410	1380	1360	1330	1300	1270	1230	1200
		Med	1190	1170	1150	1130	1110	1090	1060	1030
		Low	940	940	930	920	910	900	880	860
085	100CA	High	—	1840	1820	1800	1780	1750	1720	1670
		Med	—	1320	1320	1320	1310	1290	1270	1240
		Low	980	980	980	980	980	960	930	890
100	100CA	High	—	1800	1790	1770	1740	1700	1660	1610
		Med	—	1300	1300	1300	1290	1275	1245	1200
		Low	1035	1040	1040	1020	1000	985	930	890
125	100BA	High	1770	1760	1750	1740	1720	1700	1670	1630
		Med	1340	1330	1330	1320	1310	1300	1280	1260
		Low	1020	1020	1020	1020	1020	1010	990	970
	100CA	High	2170	2170	2160	2150	2140	2120	2100	2060
		Med	1620	1620	1620	1620	1620	1620	1610	1600
		Low	1400	1400	1400	1400	1400	1400	1390	1380

SunPath™ Single Package Heat Pump



Total Comfort in One Compact Unit

The SunPath heat pump wraps up year round comfort in one energy-efficient package. It will cool and dehumidify your whole house in the summer, heat it in the winter and filter the air all year long.

The SunPath offers you the comfort and convenience of a single heating and cooling system...and the energy efficiency of a heat pump. State-of-the-art computerized controls develop this heat pump efficiency to the maximum, while providing the dependability of solid-state circuitry.

You lose no valuable interior space when you install a SunPath heat pump. It installs entirely outside your home, on the ground or on the rooftop.

The Heat Pump Principle

There is always some heat in the air...until the temperature reaches 460° below zero. Even at -10°F, the air contains 84% of the heat normally available at 75°F. A heat pump captures this heat and transfers it.

In the winter, the heat pump heats your home by extracting heat from the outside air and transferring it inside your house. In the summer, it cools your house by transferring the heat from inside your house to the outside. The actual transfer is done with a fluid (refrigerant) which is circulated by a pump (compressor).

Year Round Dependability
Most ordinary heat pumps are controlled by complicated electro-mechanical controls. Not the SunPath heat pump.

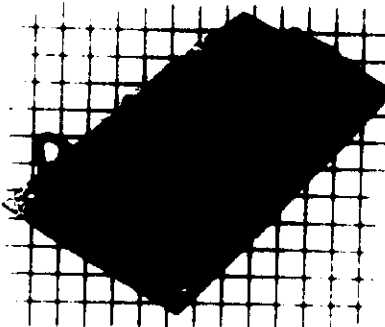
It is entirely controlled by the YorkGuard® computer control module, for maximum dependability. Complementing the dependability of high technology electronic controls are long-proven quality features, such as copper tubing in all coils. York gives you the best of both worlds.

State-of-the-Art Computer Controls

The SunPath heat pump is controlled by the YorkGuard computer module, which gives you a unique combination of comfort, dependability and energy savings. The YorkGuard module is the big difference between York and all other heat pumps.

This exclusive YorkGuard solid-state control module monitors, controls and protects all vital components. It even enables the SunPath heat pump to operate down to -10°F, lower than most other heat pumps.

When a York Energy Techniques Specialist installs your SunPath, he will adjust the YorkGuard module settings for the most efficient operation of the heat pump in your home, for maximum energy savings.



YorkGuard, Computer Control Module

Balance Point Calculated for Your Home

Above a certain outside temperature (calculated by your York dealer), the heat pump will provide all the heat for your home. Below this temperature, called the balance point, supplemental heat is necessary. Electric heating elements in the heat pump provide this supplemental heat.

Your York Energy Techniques Specialist can set the balance point on the SunPath heat pump at various points from 43°F to 23°F. This enables him to "fine tune" your heat pump to your home and your area's climate, for maximum efficiency. Only York offers this flexibility.

Computerized Defrosting

During the heating season, the outside coils on a heat pump need occasional defrosting. This is accomplished by reversing the refrigerant flow in the system. During defrosting, heat is supplied to your home by supplemental electric heat elements.

Most heat pumps defrost on a time-temperature cycle. This often results in unnecessary defrosting and reduced efficiency of the heat pump.

The YorkGuard computer module monitors the condition of the SunPath coils to start and stop defrosting precisely as needed. This "Demand Defrost" eliminates unnecessary defrosts, saves money and lengthens the life of the heat pump.

V
S
M
F

YEAR 6

1535861 BORG-WARNER CENTRAL

50C 12631R-27-11-05

SunPath™ Heat Pump System Components

Compressor

The energy-efficient compressor is a heavy-duty model made specifically for heat pump operation.

Accumulator

Unique York design protects the compressor from damaging flood-back of refrigerant.

Suction Line Heat Exchanger*

This exclusive York-patented feature provides extra protection against refrigerant entering the compressor. This increases compressor life.

Fan

Super quiet operation is the result of a slow speed fan. Compressor is isolated from the fan's air stream to further reduce outside noise levels.

Blower

The centrifugal blower provides ample air flow for long duct runs, yet is quiet in operation. It is direct driven, so there are no belts to replace.

Insulation

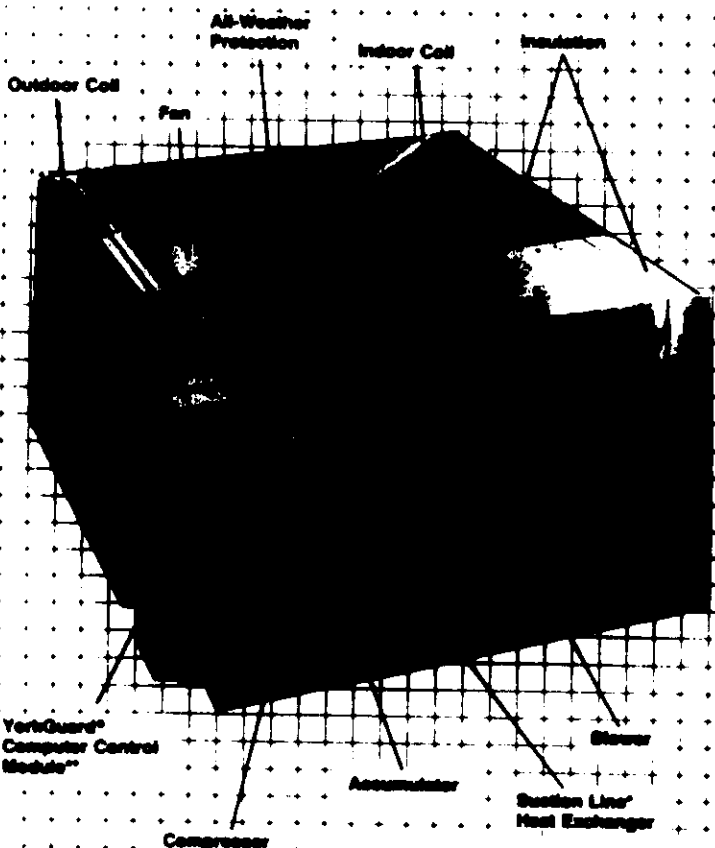
High quality foil-faced insulation is used in the conditioned air compartment. This prevents the conditioned air from losing or gaining heat from the outside air. The result is increased energy savings.

All-Weather Protection

Quality enamel is applied over specially treated metal. A multi-step electrostatic process is used to assure uniform coverage.

YorkGuard™ Computer Control Module**

The patented YorkGuard™ module controls 19 different functions, assuring that the SunPath heat pump is operating as efficiently as possible.



York Protects

Your Investment

York offers one of the finest warranty programs in the industry. The SunPath heat pump is protected by a one year limited parts warranty on the complete unit plus an additional four years on the key components, the compressor, and the YorkGuard module.

An optional Comfort Assurance Plan is available through the fifth year. Ask your York dealer for more information on this innovative service plan.

York Energy Techniques

Specialists at Your Service

The purchase of a heating and air conditioning system is an important decision and investment for you and your family. It is essential that you choose the right equipment for your needs and that the equipment be properly installed.

York dealers are Energy Techniques Specialists who can assist you in these important decisions. They help you determine the proper equipment...design the installation to provide heating and cooling with efficiency...and can even give you a computerized estimate of your annual operating costs.

Should your SunPath heat pump ever require service, your York dealer can quickly and accurately diagnose the problem with a portable electronic analyzer that plugs into the heat pump.

Your SunPath™ heat pump is manufactured by York, an energy techniques leader in the heating and air conditioning industry.

For many reasons...York is the right decision.

*Patent No. 4,036,575 **Patent No. 4,187,380

York Computerized Thermostat

To complement the efficiency of your geothermal heat pump, York offers an optional computerized thermostat that can substantially reduce your heating and cooling costs.

You can program this electronic thermostat to an exact level of comfort and energy savings (as many as two dollars a day).

Simply set the thermostat for your comfort temperature and for your energy saving periods. The thermostat does the rest automatically.

An attractive finger cover guards the programming keyboard. With the cover in place, only the digital readout temperature indicator array shows.

York...The Right Decision

York is the right decision for two reasons. It offers the best choice of heating and air conditioning systems. And your York dealer is the Energy Techniques Specialist just qualified to help you choose the right system for your home. Ask him about the Sun Heat heat pump today.

B2SP024A06

COUIN
MBA
NETCAP SEE
(226) B5

Capacity Tons	Efficiency			SEER	Energy Savings Potential			Annual Operating Costs
	Capacity Tons	SEER	ASHRAE		SEER	Capacity Tons	SEER	
1.5	1.5	12.0	12.0	12.0	12.0	1.5	12.0	12.0
2.0	2.0	12.0	12.0	12.0	12.0	2.0	12.0	12.0
2.5	2.5	12.0	12.0	12.0	12.0	2.5	12.0	12.0
3.0	3.0	12.0	12.0	12.0	12.0	3.0	12.0	12.0
3.5	3.5	12.0	12.0	12.0	12.0	3.5	12.0	12.0
4.0	4.0	12.0	12.0	12.0	12.0	4.0	12.0	12.0
4.5	4.5	12.0	12.0	12.0	12.0	4.5	12.0	12.0
5.0	5.0	12.0	12.0	12.0	12.0	5.0	12.0	12.0

Operating at 230 volts

Pressure Rating: 100 psig with ASHRAE 90.1-1989

See dealer for the right to use the York logo and name with your system.



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BORG WARNER

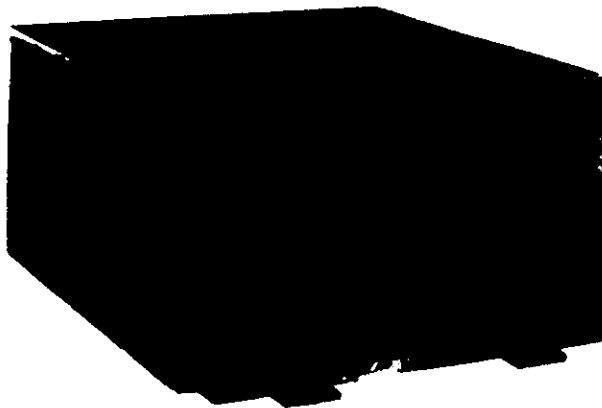
YORK.

SUNPATH

SINGLE PACKAGE HIGH EFFICIENCY HEAT PUMP

Models: 8" SPO24
thru 8" SPO60

Nominal Capacities:
Cooling 22.5 thru 62.5 Mbt
Heating 22.5 thru 65.0 Mbt



DESCRIPTION

THE YORK SUNPATH SINGLE PACKAGE HEAT PUMP is a product specifically designed for heating and cooling a home or small business. We have incorporated the latest and most modern air conditioning techniques in designing this SunPath Heat Pump for economical operation.

FEATURES

ECONOMICAL

1. LOW OPERATING COST - High efficiency cooling and heating cycle - up to 8.50 SEER on cooling and 7.10 HSPF on heating.
2. DEFROST ON DEMAND - Defrost initiation control starts a defrost cycle only when needed, saving energy.
3. DEFROST TERMINATION CONTROL - Positive defrost termination is unaffected by adverse climatic conditions. Assures defrost termination even during high winds. Results in minimum time on defrost cycle.
4. EXTENDED HEAT PUMP OPERATION - Heat pump operation to -10° F outdoor temperature.

RELIABLE

1. SOLID STATE CONTROLS - Unique YORKGUARD Solid State operating and safety controls provide long lasting and reliable performance.
2. HEAVY DUTY COMPRESSOR - Developed specifically for heat pump applications.

3. SUCTION LINE ACCUMULATOR - Special design protects compressor against liquid flood back at all operating conditions.
4. COMPRESSOR ANTI-CYCLE TIMER - Five minute timer prevents rapid cycling of compressor caused by a power outage or abnormal unit operating conditions.
5. SUCTION LINE HEAT EXCHANGER - Patented suction line heat exchanger provides liquid refrigerant vaporization which results in longer compressor life and increased unit efficiency.
6. FACTORY REFRIGERANT CHARGE - Factory charged with Refrigerant R-22 to provide exact refrigerant charge.

SERVICEABILITY

1. EASY ACCESS - Provided by removable panels to all controls and components.
2. INDOOR SECTION - Direct drive multi-speed motor with high static pressure capability. ARI rated at the drum speed.
3. THERMOSTAT - Contains an emergency reset switch and light. Light indicates malfunction of heat pump system and/or operation on emergency heat.
4. TEST AND MAINTENANCE ACCESSIBILITY - Solid State Module and all components designed for easy access.
5. SERVICE ANALYZER - Versatile service analyzer instrument checks control components and solid state module performance.

FOR DISTRIBUTION USE ONLY - NOT TO BE USED AT POINT OF RETAIL SALE

ARI RATINGS*

Cooling and Heating for DOE Covered SunPath Heat Pump

MODEL	RATING VOLTAGE	COOLING			HEATING			SOUND RATING NO.
		CFM	NET CAPACITY MBH	EER	NET CAPACITY MBH @ 47°F	NET CAPACITY MBH @ 17°F	HSPF	
B2SP024A06	230-1-60	880	22.6	8.50	22.8	12.4	6.50	7.8
B2SP030A06	230-1-60	1050	27.5	8.35	30.2	17.4	6.75	8.0
B2SP036A06	230-1-60	1275	35.0	8.35	34.8	19.0	6.85	8.2
B1SP042A06	230-1-60	1400	38.5	7.70	43.5	24.0	6.80	8.4
B1SP048A06	230-1-60	1650	46.0	7.70	48.0	27.0	6.60	8.2
B2SP060A06	230-1-60	2000	56.0	8.10	57.5	34.0	7.10	8.4

*Rated in accordance with DOE test procedures.

EER (Seasonal Energy Efficiency Ratio) is the total cooling output in Btu's during a normal annual usage period for cooling divided by the total electric power input in watt hours during the same period.

HSPF (Heating Seasonal Performance Factor) is the total heating output during a normal annual usage period for heating divided by the total electric power input during the same period. Region IV Min. D.H.R.

†Deduct 500 Btuh for 208V.

‡Deduct 1000 Btuh for 208V.

Cooling and Heating for Non-DOE Covered SunPath Heat Pump

MODEL	RATING VOLTAGE	COOLING				HEATING						SOUND RATING NO.
		CFM	MBH	KW	EER	@ 47°F			@ 17°F			
						MBH	KW	COP	MBH	KW	COP	
B2SP024	230 3-60	1275	35.0	4.30	8.10	34.8	3.4	3.00	19.0	2.8	2.00	8.2
B2SP048	230 3-60	1650	46.0	5.90	7.75	48.0	5.0	2.80	27.0	4.1	1.90	8.2
B1SP048	460 3-60	1650	46.0	5.78	7.75	48.0	4.78	2.80	27.0	3.86	1.90	8.2
B2SP060	230 3-60	2000	62.5	7.70	8.15	65.0	6.4	2.95	38.0	5.1	2.15	8.4
B1SP060	460 3-60	2000	62.5	7.71	8.10	65.0	6.54	2.90	39.0	5.3	2.10	8.4

*Tested in accordance with ARI Standards 240 and 270.

†EER (Energy Efficiency Ratio)

‡MBH (Output) Total KW Input

§COP (Coefficient of Performance)

|| MBH (Output) Total KW Input x 3.415

¶Deduct 500 Btuh at 208V.

**Deduct 1000 Btuh at 208V.

††Deduct 0.1 KW at 208V.

‡‡Deduct 0.2 KW at 208V.



MAXIMUM AVAILABLE EXTERNAL S.P. AT ARI CFM—INDOOR UNIT

MODEL	B2SP024		B2SP030		B2SP036		B1SP042		B1SP048		B2SP060	
CFM	880		1050		1275		1400		1650		2000	
1 W.G.*	24	39	41	44	62	79	84	90	56	68	65	80

*Values are for 208/230 or 480 volts for the CFM's listed (Return Air Filter and Largest Electric Heater included)

HEAT PUMP APPLICATION RATINGS (HEATING)

230-1-60

MODEL	OUTDOOR TEMPERATURE °F													
	-8		2		12		22		32		42		52	
	MBH	COP	MBH	COP	MBH	COP	MBH	COP	MBH	COP	MBH	COP	MBH	COP
B2SP024	7.1	1.23	8.8	1.41	11.4	1.70	14.3	1.99	17.7	2.31	21.3	2.62	25.0	2.98
B2SP030	10.0	1.29	12.4	1.48	15.0	1.68	18.0	1.97	22.8	2.27	28.0	2.64	33.8	3.01
B2SP036	10.6	1.22	13.5	1.48	17.1	1.78	20.9	2.05	25.8	2.38	31.7	2.74	37.8	3.08
B1SP042	13.7	1.32	17.5	1.54	21.8	1.80	26.4	2.06	32.4	2.36	38.7	2.69	47.0	2.98
B1SP048	16.0	1.31	20.1	1.54	24.7	1.78	29.8	2.00	36.0	2.27	43.8	2.58	51.7	2.86
B2SP060	18.5	1.39	23.0	1.58	29.1	1.85	36.8	2.15	45.0	2.47	53.5	2.75	62.0	3.00

MBH - Based on indoor unit without supplemental electric heat and 70° DB entering indoor air at 400 CFM/ton and 72% RH outdoor air and 230 V operation.

COP - Includes power input for compressor, outdoor fan motor, indoor blower motor and allowance for defrost.

230/460-3-60

MODEL	OUTDOOR TEMPERATURE °F													
	-8		2		12		22		32		42		52	
	MBH	COP	MBH	COP	MBH	COP	MBH	COP	MBH	COP	MBH	COP	MBH	COP
B2SP036 ¹	10.6	1.22	13.5	1.48	17.1	1.78	20.9	2.05	25.8	2.38	31.7	2.74	37.8	3.08
B1SP048	16.0	1.31	20.1	1.54	24.7	1.78	29.8	2.00	36.0	2.27	43.8	2.58	51.7	2.86
B2SP060	22.8	1.64	27.8	1.81	34.0	2.02	42.4	2.32	51.3	2.60	60.5	2.85	69.5	3.06

MBH - Based on indoor unit without supplemental electric heat and 70° DB entering indoor air at 400 CFM/ton and 72% RH outdoor air and 230-3-60 or 460-3-60 operation.

COP - Includes power input for compressor, outdoor fan motor, indoor blower motor and allowance for defrost.

¹ Available in 230 volts only

ELECTRIC HEATING CAPACITY

HEAT PUMP MODEL NO.	ELECTRIC HEATER MODEL NO.	TOTAL HEAT KW	RATING AT 240 VOLTS ¹				RATING AT 480 VOLTS ¹			
			SUPPLEMENTAL HEAT		SUPPLEMENTAL & STANDBY HEAT		SUPPLEMENTAL HEAT		SUPPLEMENTAL & STANDBY HEAT	
			KW	MBH	KW	MBH	KW	MBH	KW	MBH
B2SP024	2HA08500508	5	5	17.1	5	17.1	5	17.1	—	—
	2HA08501008	10	10	34.2	10	34.2	—	—	—	—
	2HA08501208	12	10	34.2	12	41.0	—	—	—	—
B2SP030	2HA08500508	5	5	17.1	5	17.1	—	—	—	—
	2HA08501008	10	10	34.2	10	34.2	—	—	—	—
	2HA08501508	15	10	34.2	15	51.2	—	—	—	—
B2SP036	2HA08501008 (25)	10	10	34.2	10	34.2	—	—	—	—
	2HB08501508	15	15	51.2	15	51.2	—	—	—	—
	2HA08502008	20	15	51.2	20	68.3	—	—	—	—
B1SP042	2HC08501508	15	15	51.2	15	51.2	—	—	—	—
	2HB08502008	20	15	51.2	20	68.3	—	—	—	—
	2HA08502508	25	15	51.2	25	85.4	—	—	—	—
B1SP048	2HC08501508 (25)	15	15	51.2	15	51.2	—	—	—	—
	2HA08501548	16	—	—	—	—	16	54.7	16	54.7
	2HC08502008 (25)	20	20	68.3	20	68.3	—	—	—	—
	2HB08502508 (25)	25	20	68.3	25	85.4	—	—	—	—
B2SP060	2HC08501508 (25)	15	15	51.2	15	51.2	—	—	—	—
	2HA08501548	16	—	—	—	—	16	54.7	16	54.7
	2HC08502508 (25)	25	25	85.4	25	85.4	—	—	—	—
	2HA08503025	30	25	85.4	30	102.6	—	—	—	—
	2HA08503508	35	25	85.4	35	119.5	—	—	—	—

¹ For outdoor design conditions of -10°F and above select electric heater from "Supplemental Heat" column; for conditions below -10°F select electric heater from "Supplemental Plus Standby Heat" column.

ELECTRIC HEATER OPERATION

1. Standby heat is used when heat pump operation is undesirable due to low outdoor air temperature (compressor is off). Standby heat is also used for emergency heat.
2. During Defrost, 5 Kw energizes on all heaters; models B2SP024 thru B2SP036. For models B1SP042, B1SP048, and B2SP060; 10 Kw is energized on all heaters.

ELECTRIC HEATER CORRECTION FACTOR

RATING VOLTAGE	VOLTAGE	KW CAPACITY MULTIPLIER
240	208	0.75
	230	0.92
	240	1.00
480	440	0.84
	480	0.92
	480	1.00

UNIT ELECTRICAL DATA

MODEL	UNIT POWER SUPPLY ¹	COMPRESSOR		EVAPORATOR BLOWER MOTOR		CONDENSER FAN MOTOR		MIN. CIRCUIT AMPACITY ²	MAX. DUAL ELEMENT FUSE SIZE ³ (TIME DELAY)	MIN. WIRE SIZE AWG ³
		RLA	LRA	FLA	LRA	FLA	LRA			
B2SP024A08	230-1-60 208-1-60	14.9	63	1.5	2.25	1.3	3.4	16.2	25	12
B2SP030A08	230-1-60 208-1-60	15.4	80	3.0	6.6	2.0	5.2	21.5	35	10
B2SP036A08	230-1-60 208-1-60	19.1	83.5	3.3	6.6	2.0	5.2	26	35	10
B2SP036A25	230-3-60 208-3-60	11.3	66	3.3	6.6	2.0	5.2	17	25	12
B1SP042A08	230-1-60 208-1-60	23.0	95.4	4.5	6.5	2.5	7.5	32	40	8
B1SP048A08	230-1-60 208-1-60	27.0	114	4.8	6.5	2.5	7.5	37	45	8
B1SP048A25	230-3-60 208-3-60	16.8	84	4.8	6.5	2.5	7.5	24	30	10
B1SP048A48	480-3-60	8.2	42	2.3	4.1	1.6	4.2	11.9	20	14
B2SP060A08	230-1-60 208-1-60	30.7	125	5.2	9.6	2.5	7.6	41.1	60	6
B2SP060A25	230-3-60 208-3-60	21.4	115	5.2	9.6	2.5	7.6	29.5	50	10
B2SP060A48	480-3-60	11.3	50	3.0	5.6	1.6	4.55	15.7	25	12

RLA = Running Load Amps, FLA = Full Load Amps, LRA = Locked Rotor Amps

¹ Minimum Voltage: 208/230 = 187-262; 480 = 432-504² Compressor and condenser fan motor only.³ Based on 80° C, 3% voltage drop and maximum length of 100 feet. Use copper conductors only.

ELECTRICAL DATA — ELECTRIC HEAT

MODEL	ELECTRIC HEAT ACCESSORY MODEL	KW RATING			MIN. CIR. AMPERITY			MAX. FUSE SIZE			MINIMUM WIRE SIZE - AMP			
		208V	230V	400V	208V	230V	400V	208V	230V	400V	208V	230V	400V	400V
B2SP024A06	2HA08500508	3.8	5.0	—	27	30	—	60	60	—	10/10	10/10	—	—
	2HA08501008	7.5	10.0	—	50	57	—	80	80	—	8/4	8/8	—	—
	2HA08501208	9.0	12.0	—	57	65	—	80	70	—	4/4	8/8	—	—
B2SP030A06	2HA08500508	3.8	5.0	—	27	30	—	30	30	—	10/10	10/10	—	—
	2HA08501008	7.5	10.0	—	50	57	—	50	80	—	8/4	8/8	—	—
	2HA08501208	11.3	15.0	—	72	82	—	80	80	—	3/2	4/4	—	—
B2SP036A06	2HA08501008	7.5	10.0	—	50	57	—	50	80	—	8/4	8/8	—	—
	2HB08501508	11.3	15.0	—	72	83	—	80	80	—	—	3/2	—	—
	2HA08502008	15.0	20.0	—	95	108	—	100	110	—	—	2/2	—	—
B2SP036A25	2HA08501025	7.5	10.0	—	42	48	—	45	50	—	8/8	8/8	—	—
	2HC08501508	11.3	15.0	—	75	85	—	80	90	—	3/2	4/4	—	—
	2HB08502008	15.0	20.0	—	97	111	—	100	125	—	—	3/2	—	—
B1SP042A06	2HA08502508	18.8	25.0	—	119	137	—	125	150	—	—	1/0	—	—
	2HD08501508	11.3	15.0	—	75	85	—	80	90	—	3/2	4/4	—	—
	2HC08502008	15.0	20.0	—	97	111	—	100	125	—	—	3/2	—	—
B1SP048A06	2HB08502508	18.8	25.0	—	119	137	—	125	150	—	—	1/0	—	—
	2HD08501525	11.3	15.0	—	46	52	—	50	60	—	—	8/8	—	—
	2HC08502025	15.0	20.0	—	67	78	—	70	80	—	—	4/3	—	—
B1SP048A25	2HB08502525	18.8	25.0	—	85	98	—	90	100	—	—	2/1	—	—
	2HD08501508	11.3	15.0	—	75	85	—	80	90	—	3/2	4/4	—	—
	2HC08502508	18.8	25.0	—	120	137	—	125	150	—	—	1/0	—	—
B2SP060A06	2HA08503508	26.3	35.0	—	165	188	—	175	200	—	—	00/00	—	—
	2HD08501525	11.3	15.0	—	46	52	—	50	60	—	—	8/8	—	—
	2HC08502525	18.8	25.0	—	86	98	—	90	100	—	—	3/3	—	—
B2SP060A25	2HA08503025	22.5	30.0	—	86	98	—	90	100	—	—	3/3	—	—
	2HD08501548	—	—	18	—	—	25.5	—	—	30	—	—	10	10
	B2SP060A48	—	—	—	—	—	—	—	—	—	—	—	—	—

VOLTAGE CODE: 06 = 208/230-1-60, 25 = 208/230-3-60, 48 = 480-3-60

NOTE: A fan relay must be used with units which have no electric heat. Refer to the fan relay electrical data table.

FAN RELAY ELECTRICAL DATA¹

MODEL	FAN RELAY ACCESSORY NO.	MINIMUM CIRCUIT AMPACITY			MAXIMUM FUSE SIZE			MINIMUM WIRE SIZE - AMP		
		208V	230V	400V	208V	230V	400V	208V	230V	400V
B2SP024-030, 036	2FR08700108	5	5	—	15	15	—	14	14	—
B1SP042, 048 B2SP060	2FR08700108	7	7	—	15	15	—	14	14	—
B1SP048 B2SP060	2FR08700148	—	—	3.0	—	—	15.0	—	—	14

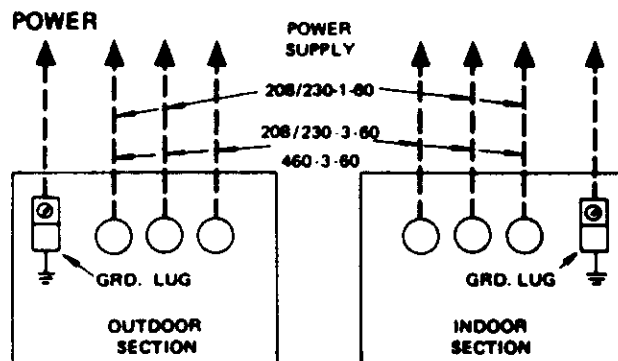
¹ The fan relay accessory is used with units which have no electric heat.
The fan relay accessory provides power to the indoor blower.² Based on 60°C insulated wire, 3% voltage drop, and maximum of 100 feet.

PHYSICAL DATA

MODEL	B2SP024	B2SP030	B2SP036	B2SP042	B2SP048	B2SP060
INDOOR FAN (Quantity 1)						
Fan Drive	Direct	Direct	Direct	Direct	Direct	Direct
Horsepower	1/5	1/3	1/3	1/2	1/2	3/4
Fan Diameter X Width (In.)	9.5/7.1	9.5/7.1	10/8	10/8	10/8	11.5/10.7
Number of Speeds	3	3	3	4	4	3
INDOOR COIL						
Rows	3	3	4	3	3	4
Face Area (Ft. ²)	3.1	4.4	4.4	6.4	6.4	7.8
OUTDOOR FAN (Quantity 1)						
Horsepower	1/4	1/3	1/3	1/3	1/3	1/2
Propeller Fan Diameter (In.)	18	20	20	22	22	24
OUTDOOR COIL						
Rows	3	2	3	2	3	4
Face Area (Ft. ²)	4.4	6.3	6.3	8.5	8.5	9.5
RECOMMENDED FILTERS ¹						
Quantity	1	2	2	2	2	2
Size (In.)	14 x 25 x 1	14 x 20 x 1	14 x 20 x 1	14 x 25 x 1	14 x 25 x 1	16 x 25 x 1
WEIGHT (Lbs.)						
Operating	322	347	386	420	445	575
Shipping	348	380	418	460	489	622

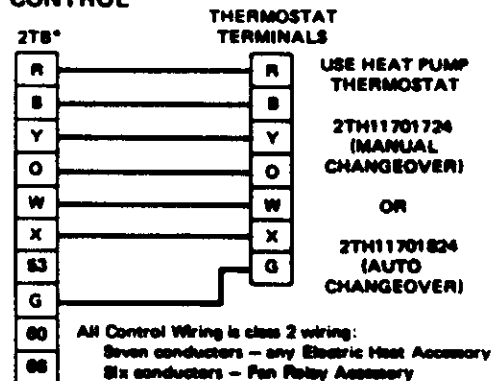
¹ Field supplied high velocity filters for direct installation.

FIELD WIRING DIAGRAMS — (MODELS B2SP024 thru B2SP060)



NOTE: POWER AND GROUND WIRING SHOULD BE SIZED IN ACCORDANCE WITH LOCAL ELECTRIC CODES.

CONTROL



* Located in Indoor Section of Unit.

ACCESSORIES FOR FIELD INSTALLATION

START ASSIST KIT — For low voltage conditions.

FAN RELAY — (Required only when no electric heaters are needed).

ELECTRIC HEATER MODULE — Sequencers, temperature limit switches, fusible links and circuit breakers for safe, efficient operation.

FIRESTAT — Senses abnormal return air temperature.

STATUS PANEL — Monitoring station for ventilation controls, indicator lights, dirty filter indicator.

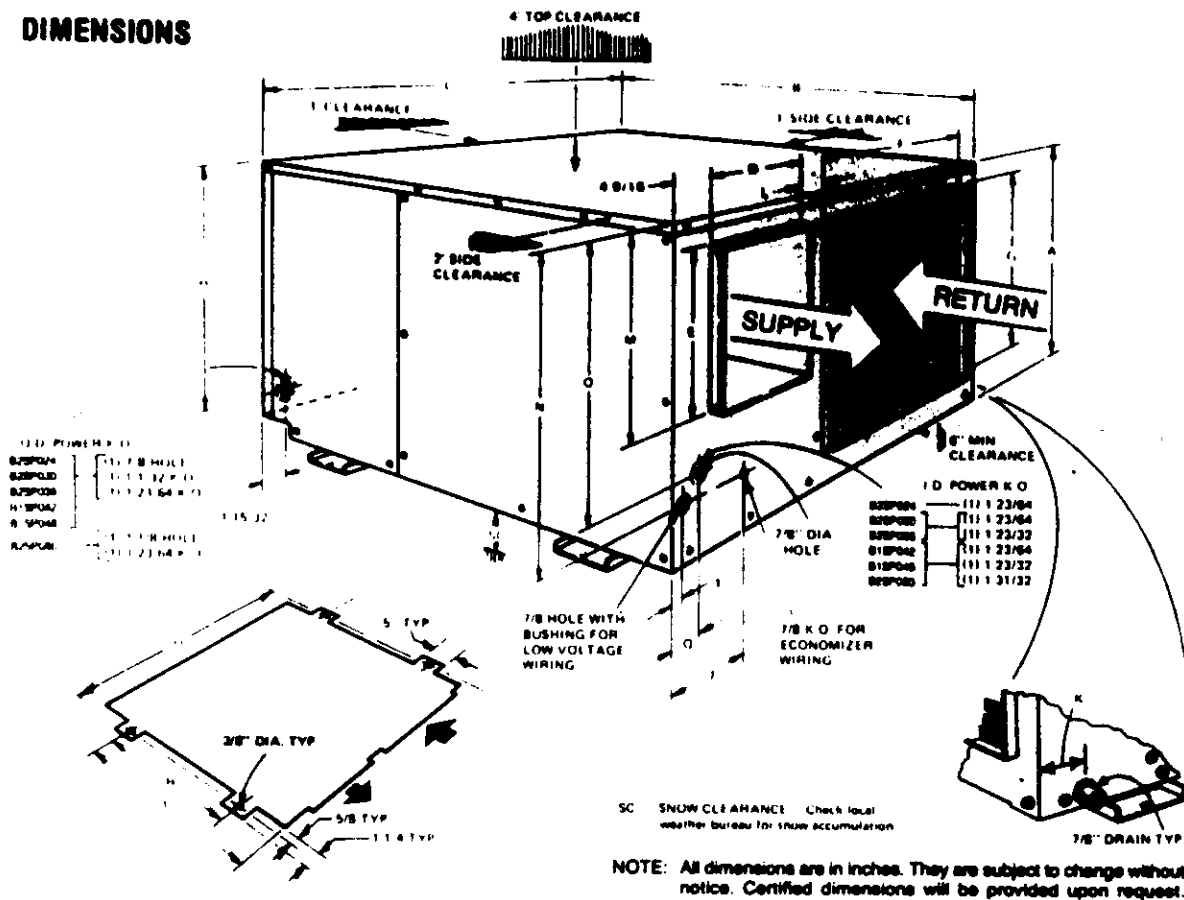
COMMERCIAL ACCESSORIES — Refer to 600.51 section for information on curbs, plenums, and economizers.

OUTDOOR AMBIENT THERMOSTAT ACCESSORY — Consists of relay and outdoor thermostat in an enclosure to provide two step control of supplemental heaters.

THERMOSTAT — 24 volt, wall mounted with emergency light and switch. Manual or automatic changeover.

THERMOSTAT — Electronic; programmable for night set-back and energy savings.

DIMENSIONS

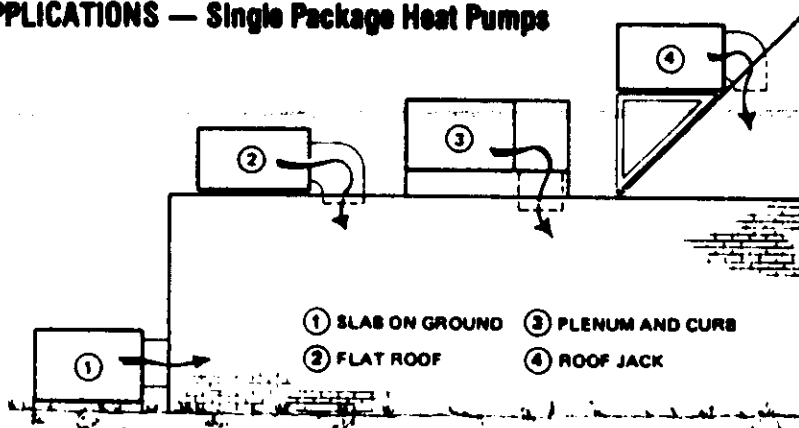


NOTE: All dimensions are in inches. They are subject to change without notice. Certified dimensions will be provided upon request.

Model	A*	B	C	D	E	F	G	H	K	L	M	N	O	Q	R	Y	U
B2SP024	24	43	40 1/2	13 1/16	12 1/8	14	18 7/8	21 3/16	2 3/32	6 7/8	14 1/8	19 5/16	19 5/16	2 3/4	23 1/8	30 3/4	41 3/4
B2SP030	24	46	51	13 1/16	12 1/8	28	18 7/8	21 3/16	5 7/8	3 1/8	14 1/8	19 11/16	19 11/16	2 3/4	28 3/8	35 3/8	62 1/4
B2SP036	24	46	51	13 1/16	12 1/8	28	18 7/8	21 3/16	5 7/8	3 1/8	14 1/8	19 11/16	19 11/16	2 3/4	28 3/8	35 3/8	62 1/4
B1SP042	29	48	58	16 5/8	12 7/16	30 1/16	23 13/16	25 1/8	6 5/16	5	14 1/2	24 1/2	21 3/8	2	28 1/2	38 9/16	66
B1SP048	29	48	58	16 5/8	12 7/16	30 1/16	23 13/16	25 1/8	6 5/16	5	14 1/2	24 1/2	21 3/8	2	28 1/2	38 9/16	66
B2SP060	29	51 1/16	65	16 5/8	12 7/16	38	23 13/16	25 1/8	5 11/16	3	14 1/2	24 1/2	21 1/2	2	27 13/16	37 9/16	66

*Not including 3/4" rail

TYPICAL APPLICATIONS — Single Package Heat Pumps



Subject to change without notice. Printed in U.S.A. POS 16M 684 .32

Code: EBY, EGY

511.06-TG1Y

Supersedes: 511.06-TG1 (183)



1535841 BORG-WARNER CENTRAL
YORK

986 12041 R-27-11-85
SUNPATH
SINGLE PACKAGE HEAT PUMPS
2 THRU 5 TONS

APPLICATION DATA

Supersedes: 511.05-AD1 (581)

tab BSP 511.05-AD1Y (784)

MODELS: B*SP024 THRU B*SP060

GENERAL INFORMATION

GENERAL

The Sunpath series single package heat pumps are self-contained, factory charged units designed for roof mounting or for slab mounting at ground level.

Units are shipped less fan motor relay. To operate the unit, a fan relay must be provided. This is done by field installing either the fan relay accessory or a supplementary electric heater accessory.

NOTE: The Sunpath unit will not operate without either an electric heater accessory or a fan relay accessory.

The fan relay accessory is applicable to all units, while only certain size electric heater accessories may be used with each unit size. One or the other must be installed in the opening provided on the downstream side of the blower.

Heaters are available in 5, 10, 12, 15, 20, 25, 30, and 35KW sizes. See Form 511.05-TG1Y or 511.05-AD1.Y for possible unit and heater combinations.

CAUTION: A 1" minimum clearances to all sides of supply air duct must be maintained up to 3 feet from the supply air duct connection flange on unit if electric heat accessory is to be installed.

A thermostat designed specifically for York Heat Pumps is also required.

APPLICATIONS LIMITATIONS

Application Limitations are as follows:

Table 1 - General voltage and Temperature

Table 2 - Indoor Air Flow

TABLE 1 - VOLTAGE AND AIR TEMPERATURE LIMITATIONS

Voltage Variation		Outdoor Air Temperature		Air Temperature Entering Indoor Coil			
				Min.		Max.	
Min.	Max.	Min. DB	Max. DB	°WB	°DB	°WB	°DB
197*	253	40	-10**	115	75	57	50***
						71	80

- * Unit will operate satisfactorily to 187 volts if outdoor ambient is not over 109 F. and indoor return air is not over 71 F. wb.
- ** Below -10 F. unit operates automatically with resistance heat only.
- *** Operation below this temperature is permissible for short period of time when required to bring the heated area up to 50 F.

TABLE 2 - MAXIMUM AND MINIMUM CFM

Model	024	030	036	042	048	060
Min. CFM	640	800	960	1120	1280	1650
Max CFM	960	1200	1440	1680	1920	2300

DIMENSIONS

Typical foundation, unit base dimension and clearances are shown in Fig 1.

REFRIGERANT CYCLE

Figures 2 and 3 are schematic refrigerant flow diagrams with the solid arrow (—→) indicating flow for cooling operation and the phantom arrow (----→) indicating heating operation.

FOR DISTRIBUTION USE ONLY - NOT TO BE USED AT POINT OF RETAIL SALE

COOLING PERFORMANCE

TABLE 1 — COOLING PERFORMANCE RATINGS* — B28P024 AT 800 CFM AND 230 VOLTS

Outdoor Temperature (°F)	Entering Wet Bulb (°F)	Total Capacity (MBH)	Sensible Capacity (MBH) @ Entering db °F				Comp. & Cond. Fan (KW)
			72°	76°	80°	84°	
75	72	26.5	—	—	—	14.9	2.31
	67	25.4	—	13.7	18.0	22.3	2.27
	62	23.5	16.2	20.2	23.5	—	2.23
	57	21.3	21.3	—	—	—	2.19
95	72	26.1	—	—	10.9	15.6	2.69
	67	23.7	9.5	13.7	17.9	22.2	2.62
	62	21.2	15.6	19.4	—	—	2.53
	57	18.2	18.2	—	—	—	2.43
115	72	22.8	—	—	10.9	15.1	2.96
	67	20.4	9.3	13.0	16.7	20.4	2.86
	62	18.0	14.4	17.6	—	—	2.73
	57	14.7	14.7	—	—	—	2.56

*Ratings are gross capacities — for net capacity, deduct evaporator blower motor heat, KW X 3.415 = MBH.

TABLE 2 — COOLING PERFORMANCE RATINGS* — B28P030 AT 1000 CFM AND 230 VOLTS

Outdoor Temperature (°F)	Entering Wet Bulb (°F)	Total Capacity (MBH)	Sensible Capacity (MBH) @ Entering db °F				Comp. & Cond. Fan (KW)
			72°	76°	80°	84°	
75	72	34.4	—	—	—	19.5	3.06
	67	32.8	—	17.9	23.6	29.2	3.03
	62	30.4	21.2	26.4	30.4	—	2.97
	57	27.6	27.6	—	—	—	2.92
95	72	33.8	—	—	14.3	20.5	3.58
	67	30.7	12.4	17.9	23.5	29.0	3.49
	62	27.5	20.4	25.4	—	—	3.36
	57	23.6	23.6	—	—	—	3.24
115	72	29.5	—	—	14.2	19.7	3.94
	67	26.4	12.2	17.0	21.9	26.4	3.80
	62	23.3	18.8	23.1	—	—	3.64
	57	19.0	19.0	—	—	—	3.41

*Ratings are gross capacities — for net capacity, deduct evaporator blower motor heat, KW X 3.415 = MBH.

TABLE 3 — COOLING PERFORMANCE RATINGS* — B28P036 AT 1200 CFM AND 230 VOLTS

Outdoor Temperature (°F)	Entering Wet Bulb (°F)	Total Capacity (MBH)	Sensible Capacity (MBH) @ Entering db °F				Comp. & Cond. Fan (KW)
			72°	76°	80°	84°	
75	72	40.5	—	—	—	22.8	3.67
	67	38.7	—	20.9	27.5	34.0	3.61
	62	35.8	24.7	30.8	35.8	—	3.54
	57	32.6	32.5	—	—	—	3.48
95	72	39.8	—	—	16.7	23.9	4.26
	67	36.2	14.4	20.9	27.4	33.9	4.16
	62	32.4	23.8	29.7	—	—	4.01
	57	27.9	27.9	—	—	—	3.86
115	72	34.8	—	—	16.6	23.0	4.70
	67	31.1	14.3	19.9	25.5	31.1	4.53
	62	27.5	21.9	27.0	—	—	4.34
	57	22.4	22.4	—	—	—	4.06

*Ratings are gross capacities — for net capacity, deduct evaporator blower motor heat, KW X 3.415 = MBH.

TABLE 11 - HEATING PERFORMANCE* B2SP030 AT 1000 CFM AND 230 VOLTS

Outdoor Temp.	60°F RETURN AIR			70°F RETURN AIR			80°F RETURN AIR		
	Capacity (MBH)	KW	COP	Capacity (MBH)	KW	COP	Capacity (MBH)	KW	COP
10	10.7	1.90	1.65	9.6	1.91	1.47	9.4	1.92	1.43
0	13.2	2.03	1.91	12.0	2.07	1.70	11.1	2.08	1.56
10	15.5	2.17	2.09	14.3	2.24	1.87	13.0	2.26	1.69
20	19.4	2.33	2.44	17.9	2.40	2.19	16.7	2.44	2.01
30	23.0	2.49	2.71	21.9	2.56	2.51	20.3	2.63	2.26
40	28.0	2.64	3.11	26.9	2.73	2.89	25.0	2.81	2.61
50	34.0	2.80	3.56	32.5	2.89	3.29	31.0	3.00	3.02
60	38.9	2.93	3.89	37.3	3.06	3.57	36.5	3.17	3.37
70				40.2	3.22	3.66	40.1	3.38	3.48

*Based on MBH - Refrigerant system only. Supplemental heat is not included.
 KW - Power input to compressor motor and condenser fan motor only.
 COP - MBH and KW shown in table which represents gross COP. For net COP, add indoor blower motor to outdoor KW.

TABLE 12 - HEATING PERFORMANCE* B2SP036 AT 1200 CFM AND 230 VOLTS

Outdoor Temp.	60°F RETURN AIR			70°F RETURN AIR			80°F RETURN AIR		
	Capacity (MBH)	KW	COP	Capacity (MBH)	KW	COP	Capacity (MBH)	KW	COP
10	11.3	2.11	1.57	10.4	2.15	1.42	9.4	2.18	1.26
0	13.7	2.32	1.73	12.5	2.37	1.54	11.5	2.40	1.40
10	16.8	2.52	1.95	16.0	2.57	1.70	14.5	2.61	1.63
20	21.2	2.70	2.30	19.6	2.76	2.08	18.4	2.81	1.92
30	26.3	2.88	2.67	24.7	2.95	2.45	23.2	3.01	2.26
40	33.2	3.05	3.19	30.8	3.14	2.87	28.8	3.22	2.62
50	39.0	3.23	3.54	37.2	3.34	3.26	35.2	3.44	3.00
60	43.4	3.40	3.74	42.1	3.53	3.49	40.5	3.66	3.24
70				45.6	3.70	3.61	45.0	3.87	3.40

*Based on MBH - Refrigerant system only. Supplemental heat is not included.
 KW - Power input to compressor motor and condenser fan motor only.
 COP - MBH and KW shown in table which represents gross COP. For net COP, add indoor blower motor to outdoor KW.

TABLE 13 - HEATING PERFORMANCE* B1SP042 AT 1400 CFM AND 230 VOLTS

Outdoor Temp.	60°F RETURN AIR			70°F RETURN AIR			80°F RETURN AIR		
	Capacity (MBH)	KW	COP	Capacity (MBH)	KW	COP	Capacity (MBH)	KW	COP
10	14.5	2.65	1.60	13.9	2.65	1.54	12.7	2.65	1.40
0	17.8	2.84	1.84	16.8	2.85	1.73	15.0	2.87	1.53
10	21.5	3.03	2.08	20.0	3.06	1.91	18.5	3.10	1.75
20	27.3	3.24	2.47	25.8	3.28	2.30	23.8	3.34	2.09
30	33.2	3.42	2.84	30.4	3.51	2.54	29.2	3.56	2.40
40	40.0	3.65	3.21	38.0	3.75	2.97	35.7	3.83	2.73
50	46.7	3.86	3.54	44.5	3.99	3.27	41.8	4.10	2.99
60	53.1	4.08	3.81	51.0	4.22	3.54	48.5	4.38	3.24
70				55.0	4.41	3.65	54.2	4.64	3.42

*Based on MBH - Refrigerant system only. Supplemental heat is not included.
 KW - Power input to compressor motor and condenser fan motor only.
 COP - MBH and KW shown in table which represents gross COP. For net COP, add indoor blower motor to outdoor KW.

APPENDIX 3

SITE VISITS, MEETINGS AND TELEPHONE CONTACTS

TELEPHONE OR VERBAL CONVERSATION RECORD For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.		DATE May 21, 1986
SUBJECT OF CONVERSATION Modified Automated Record Fire Range		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Joe Lampara	OFFICE NEDED-DC	PHONE NUMBER AND EXTENSION
PERSON CALLED Larry McIntosh	ADDRESS Range Control - Ft. Devens	PHONE NUMBER AND EXTENSION 8-617-796-2155
SUMMARY OF CONVERSATION <p>Called Larry re: demolition of existing facilities at ranges G & G-A. Larry indicated the covered mess area, Lyster bag holder; Ammo-issue point and bleachers should not be removed by the contractor. These facilities should be left in place until it can be ascertained that the cost of the new range is less than \$1,000,000. At that time these structures will or can be relocated by base personnel to other areas. If the cost of the new construction is above \$1,000,000 these facilities can be used on the new range in order to reduce the construction cost. Therefore, for the 35% concept these reference structures will be indicated as 'Removed by others'</p>		

TELEPHONE OR VERBAL CONVERSATION RECORD		DATE
For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.		May 14, 1986
SUBJECT OF CONVERSATION Modified Automated Record Fire Range		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION
Joe Lampara	NEDED-DC	
Tom Yates	Huntsville	8-873-3203
SUMMARY OF CONVERSATION		
<p>Called Tom regarding the moving target locations. He confirmed the fact that current guidelines and policy eliminate the moving targets from all considerations. The moving targets will not be installed as a future modification to the range. As a result, conduit, wiring etc associated with these emplacement will be eliminated from the design.</p> <p>Tom indicated a directive will be forthcoming in the near future which will spell out this change.</p>		

J. Lampara

NEDED-DC

Modified Automated Record Fire Range (MARF)

MEMO FOR THE RECORD

Joseph H. Lampara
Design Branch

30 Apr 1986
Mr. Lampara/mm/7205

1. Date: 7 April 1986
2. Place: Range Control, Fort Devens, MA
3. Attendees: Mr. Larry McIntosh, Ft. Devens Range Control
Mr. Greg Cavite, DEH, Ft. Devens
Mr. George Danek, NED, GES/Electrical
Mr. Tony Mackos, NED, GES/Mechanical
Mr. Joseph Lampara, NED, CES/Civil
4. Purpose: To discuss the overall size of the MARF range, its impact on the proposed Squad Automatic Weapons range (SAW) and on the existing "HOTEL" range, and to determine means of minimizing any adverse impact. In addition, data relative to power & heating requirements was obtained from post officials.
5. Background: The Fort Devens MARF range, originally entitled Remoted Targeting System range (RETS) and more recently a Modified Record Fire range (MRF), is sited on the existing G and G-A ranges and the Engineer Demonstration Area (EDA). The range consists of 16 firing lanes; each 30 meters wide (98.43 feet) for a width of 480M (1575 ft) and is 300M (984.3 ft) deep from the firing line to the most extreme target. In addition, a 100M (382 ft) area to the rear of the firing line is required for support facilities. Along each side of the range is a 30M (98.43 ft) buffer zone for construction of access roads and safety berms. During the preliminary planning and request for survey stages, the range was sited using 1 inch = 400 foot (1:400) scale Basic Information Maps. Siting on these maps indicated minimal impact on "HOTEL" range, downrange and to the right of the MARF range, and on the wooded areas east and west of G & G-A ranges and the EDA. Aerial topographic survey maps were completed in early calendar year 1986. Siting of the MARF range on these maps showed a much greater impact on the wooded areas and on "HOTEL" range than originally anticipated. At approximately this same time, it was learned that the SAW range was being relocated to a site immediately west of the MARF range. This range is currently under 35% concept design by the New York District.

To resolve these problems, a meeting was held between Fort Devens and NED personnel to discuss alternatives. Prior to the meeting, NED received verbal authorization allowing a reduction in width of each firing lane, if required, from 30M to 25M. This authorization came from Mr. Tom Yates of the Huntsville Division after clearance through the Army Directorate of Ammunition, Ranges and Targets (DART) of Fort Eustis, VA. This solution would only be used as a last resort in the event no other alternative solutions could be found.

NEDED-DC

CMT 1

SUBJECT: Modified Automated Record Fire Range (MARF)

6. Discussion: At the meeting, the impact of the range on "HOTEL" range, the SAW range and the wooded areas was discussed. Various alternatives were evaluated, including reorienting the range, moving the range laterally, reducing the number of full width lanes, and reducing the width of each lane by 5M but keeping 16 lanes.

Siting of the SAW range west of the MARF range necessitates relocation of "HOTEL" range. Therefore, the impact of the MARF range on "HOTEL" range is no longer of any concern.

Reorientation of the MARF range would not resolve either the impact on the woodlands or potential conflict with the SAW range. In fact, reorientation in an easterly direction would aggravate an already existing conflict between the outer limits of the safety fan and the post boundary. Reorienting to the west would worsen any potential conflict with the SAW range.

Shifting of the range laterally is also not a solution. Shifting to the west will aggravate any potential conflict with the SAW range. Shifting to the east will require relocation of Trainfire Road, the main paved access road to the majority of the post firing ranges. Relocation of the range to the east would not reduce the amount of clearing and grubbing of woodlands now required. In fact, it would add additional acres of woodland clearing. Relocation of Trainfire Road would also be expensive as the terrain to the east of the road drops off rapidly ending in a wetlands area - The Oxbow Wildlife Preserve.

Reducing the number of firing lanes from 16 to some number to be determined was not acceptable to Range Control because of the impact on training cycles - less lanes equate to less personnel run through on a cycle with a resultant increase in the number of cycles required. Range Control favors reducing the width of each lane but keeping the number of lanes at 16 over any reduction in the number of lanes.

It was determined that NED would coordinate with the New York District to see if a conflict between the SAW and MARF ranges actually existed. If there appeared to be a definite conflict, then NED would proceed to reduce the width of each lane by an amount necessary to resolve the conflict but not more than 5M. The additional clearing and grubbing of woodlands east & west of the range were determined not to be of sufficient justification to warrant reducing the lane widths. To minimize the clearing required, attempts would be made to reduce the overall width of the range. These would include minimizing the overall width of the safety berms by using 1:1-1/2 side slopes and having a top width of not more than 1M (3.28 ft); possibly eliminating the westerly safety berm since "HOTEL" range is to be relocated; and using, where possible, existing roads for down-range access.

NEDED-DC

CMT 1

SUBJECT: Modified Automated Record Fire Range (MARF)

7. Recommendations:

a. Coordinate with the New York District to determine if a conflict exists between the SAW and MARF ranges. (Note: Preliminary info does not show any apparent conflict. However, more definite information is being requested by the PM).

b. Utilize all possible means to reduce the overall width of the range short of reducing lane widths. Some ideas include smaller safety berms, elimination of the westerly safety berms and using existing roads for down-range access.

c. As a last resort, reduce the width of each firing lane up to the maximum allowed (5M).

CF:
Mr. Gauvreau - 112S

JOSEPH H. LAMPARA
Civil Engineering Section
Design Branch

TELEPHONE OR VERBAL CONVERSATION RECORD <small>For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.</small>		<small>DATE</small> <div style="font-size: 1.2em; font-family: cursive;">4/25/86</div>
<small>SUBJECT OF CONVERSATION</small> <div style="font-size: 1.1em; font-family: cursive;">MODIFIED AUTOMATED RECORD FIRE RANGE</div>		
<small>INCOMING CALL</small>		
<small>PERSON CALLING</small>	<small>ADDRESS</small>	<small>PHONE NUMBER AND EXTENSION</small>
<small>PERSON CALLED</small>	<small>OFFICE</small>	<small>PHONE NUMBER AND EXTENSION</small>
<small>OUTGOING CALL</small>		
<small>PERSON CALLING</small>	<small>OFFICE</small>	<small>PHONE NUMBER AND EXTENSION</small>
JOE LAMPARA	NEDED-DC	
<small>PERSON CALLED</small>	<small>ADDRESS</small>	<small>PHONE NUMBER AND EXTENSION</small>
TOM YATES	HUNTSVILLE	8-873-3203
<small>SUMMARY OF CONVERSATION</small> <div style="font-size: 1.1em; font-family: cursive;"> <p>Spoke to Tom regarding requirement for possible future 550M target line. He believes the requirement may have come about because of some possible future requirement which may never come about. He believes we should not address it at this time especially since Fort Devens officials can see no need for such a requirement beyond the 400M line they requested. He will check on this and if there is a change he will call back.</p> <p>I asked him if he had copies of the 35% review comments for this or similar ranges at FORT DRUM. He directed me to Mr Paul Riviera P.M. at the New York District (F.T.S. 8-264-6072).</p> </div>		

TELEPHONE OR VERBAL CONVERSATION RECORD For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.		DATE 4/25/86
SUBJECT OF CONVERSATION MODIFIED AUTOMATED RECORD FIRE RANGE		
INCOMING CALL		
PERSON CALLING Larry McIntosh	ADDRESS Range Control, Ft. Devens	PHONE NUMBER AND EXTENSION 8-617-796-2155
PERSON CALLED Joe Lampara	OFFICE NEDED-DC	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION
SUMMARY OF CONVERSATION <p>Larry called re: requirement for 550M distance from firing line to possible future target placements. He is unaware of reason for this or where the requirement came from. He does not require 550M, but does require a future 400M target line which we are already accomodating by siting the firing line in such a position as to allow a future 400M target line w/o impacting on either the MARE range or the KD range.</p>		

TELEPHONE OR VERBAL CONVERSATION RECORD		DATE
For use of this form, see AR 340-13; the proponent agency is The Adjutant General's Office.		4/3/86 1/3
SUBJECT OF CONVERSATION Modified Automated Record Fire Range (MARFR)		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Joe Lampara	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED Tom Yates	ADDRESS Huntsville	PHONE NUMBER AND EXTENSION 8-873-3203
SUMMARY OF CONVERSATION <p>Called Tom re: size and location of MARFR at Fort Devens. An overlay of the outline of the range (1575' wide x 984' deep) plus a 100' buffer strip along each side of the range for access and service roads, placed on the recently completed topographic survey, indicates a greater impact on the South Post area than originally assumed. The preliminary layout, done on 1:400 scale Basic Information Maps showed the range fitting into the existing cleared area for the existing G & G-A ranges and the engineer training demonstration area. However, the 1:50 survey shows the range and buffer zones extending from Transfere Rd (about 300' inside the tree-line on the left to a point about 160' inside the tree-line on the right. The obvious impact is increased cost of construction of the MARFR.</p>		

Modified Automated Record Fire Range
(Tom Yates)

4/3/86

Less obvious is the impact on Trainfre Rd and on Hotel range. The range may have to be moved further right to increase the separation between the road and the MARFR. This would increase the impact on Hotel range. The existing firing line at Hotel range was to be moved to place it outside of the safety fan of the MARFR. However, the preliminary overlay plan now shows all of Hotel range will fall within the safety fan and there appears to be no place the firing line can be moved to.

My question to Tom was: so, it possible for us (NED) to reduce each firing lane by some amount (to be determined - but assumed for talking purposes to be 5m) such that the overall size of the range will be reduced enough to minimize or eliminate some adverse impacts. He could not unilaterally answer that question because the range format and layout was developed by DAR and TRADOC to meet specific criteria. He is going to try to get an answer for me prior to a scheduled meeting on Monday 4/7/86 at Fort Owens to discuss this problem.

Additional Comments: I spoke to Larry McIntosh (Range Control) and Mr. Cawth (Mstr

Modified Automated Record Fire Range
(Tom Yates)

4/3/86

Plmn) both of Fort Devens regarding the above.
The meeting is to show them the layout
and discuss the impacts. It is possible that
the post can live with the range as it now
sits. However, they want to see it before
making any commitments.

SUBJECT: RETS for Ft. Devens

Meeting held at South Post of Fort Devens on 7 April 1986

Attendees:	Mr. Mackintosh	-	Range Officer	Devens
	Mr. Lampara	-	NED	
	Mr. Mackos	-	NED	
	Mr. Danek	-	NED	

Questions by Mackos with Mackintosh response:

1. Which style range building?-

Use style 2 per Mackintosh.

2. Can an oil truck get to site easily?

Yes. Use oil fired heat.

3. Do they want coed latrine as shown on std. dwg.?

No. Put two separate entrance doors, add one additional commode for men and raise interior partition to roof height.

No heat in latrine - do not need insulation in walls.

4. Ammo building - no heat or insulation in walls.

5. Range will be used 24 hours per day 365 days per year.

6. Add intrusion alarm system per Mackintosh.

TELEPHONE OR VERBAL CONVERSATION RECORD <small>For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.</small>		<small>DATE</small> <div style="font-size: 1.2em; font-family: cursive;">4/4/86</div>
<small>SUBJECT OF CONVERSATION</small> <div style="font-size: 1.1em; font-family: cursive;">MODIFIED AUTOMATED RECORD FIRE RANGE</div>		
<small>INCOMING CALL</small>		
<small>PERSON CALLING</small> <div style="font-family: cursive;">Tom YATES</div>	<small>ADDRESS</small> <div style="font-family: cursive;">HUNTSVILLE</div>	<small>PHONE NUMBER AND EXTENSION</small> <div style="font-family: cursive;">8-873-3203</div>
<small>PERSON CALLED</small> <div style="font-family: cursive;">JOE LAMPARA</div>	<small>OFFICE</small>	<small>PHONE NUMBER AND EXTENSION</small>
<small>OUTGOING CALL</small>		
<small>PERSON CALLING</small>	<small>OFFICE</small>	<small>PHONE NUMBER AND EXTENSION</small>
<small>PERSON CALLED</small>	<small>ADDRESS</small>	<small>PHONE NUMBER AND EXTENSION</small>
<small>SUMMARY OF CONVERSATION</small> <div style="font-family: cursive; font-size: 1.1em;"> <p>He indicated he had called Cpt Holloway of the Directorate of Ammunition, Ranges and Targets (DART) at Fort Eustis, VA. - There is no objection to reducing the width of each lane up to a maximum of 5M. The reduction is to be taken from the center of each lane keeping the relative distance between targets in adjacent lanes the same as it is now. This is to be done as a last resort.</p> </div>		

TELEPHONE OR VERBAL CONVERSATION RECORD		DATE
For use of this form, see AR 340-13; the proponent agency is The Adjutant General's Office.		OCT. 18, 1985
SUBJECT OF CONVERSATION MODIFIED RECORD FIRE RANGE, FORT DEVENS MA (MRF)		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING JOE LAMPARA	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED TOM YATES	ADDRESS HUNTSVILLE	PHONE NUMBER AND EXTENSION 8-873-3203
SUMMARY OF CONVERSATION		
<p>Called Tom re: size of range safety fan as shown in HNDM 1110-1-5 <u>Design Information for Infantry Rifle Marksmanship Ranges</u> versus the safety fan for individually fired shoulder arms in AR 385-63 <u>Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat.</u></p> <p>Tom indicates that the range fan for the MRF is based on a 'limit of fire' parallel to the 'line of sight' from the firing point to the nearest targets which are 10 meters to the left and right of the lane & 50 meters downrange. This accounts for the 15° deflection shown on the fan given in HNDM 1110-1-5. From this line the standard 10° deflection for ricochet and dispersion is</p>		

added giving a total of 25° . The range fans as shown in AR 385-63 do not account for the wide lanes associated with the RETS (Remote Targeting System) ranges and therefore do not reflect the 15° angle to establish the limit of fire.

Tom also indicated that in early Nov. 85 the design memo will be revised and that we will be sent a copy.

MEMORANDUM OF MEETING

1. PURPOSE:

Pre-design Meeting at Fort Devens for Modified Auto Record Fire Range, PN 189, Ft. Devens, MA

2. DATE: 19 December 1985

3. ATTENDANCE:

<u>Name</u>	<u>Organization/Position</u>	<u>Telephone</u>
Christopher Alley	NEDED-P/Trainee	647-8512
Anthony Siegel	NED-D-S/E	647-8472
Joann Murphy	Ft. Devens/USAISC	796-3089
Joseph Lampara	NEDED-D/Engineer	647-8205
Bob Harrington	NEDED-G/Chief	647-8083
Greg Cravedi	Ft. Devens/Master Planner	796-3262
Larry McIntosh	Ft. Devens/Range Control	796-2380
Bob Gauvreau	NEDED-P/Project Mgr	647-8512

4. DISCUSSION:

McIntosh

- Range to be wired for moving targets but no moving targets installed at this time.

- Can get additional info on range from FM 25-7, "Training Ranges", TRADOC.

- Would like 35% by July.

- There exists power at the site.

- There exists access to site, road through range to be abandoned or incorporated into range. (No asphalt or gravel), re-routing of traffic around range possibly upgrading existing one lane gravel road to two lanes.

- Road work can be done by Ft. Devens if they can get their engineers.

Lampara

- Devens to Lampara about 15 Feb 85 "Don't worry about roads or power".

Gauvreau

- 1391, 24 Sep 84, 16 Lanes \$630,000
- 1391, 24 Jun 85, 16 Lanes, \$890,000

Lampara

- Road material available? (No gravel in range)

McIntosh

- Good material for roads on base

Lampara

- Danger zone variance needed?

McIntosh

- No variance needed
- No options for more suitable terrain on base. Vegetation to be planted, need for recontouring, fill available on base plus old berms.
- Gravel walk to back of continuous firing berm is OK.
- No "zero range" to be included.
- Keep Under \$1M. Cut extras if need be. i.e., latrine, bleachers, etc.

Lampara

- If rerouting of road is to be done by Corps, additional survey will be needed and GEB will have to be brought in. (This cost not included in original E&D estimate).

McIntosh

- Comm & powr project is scheduled for '89 but is 100% designed and could be pushed up to '88 or even '86.

Murphy

- Raise \$3K estimate for communications to \$7K.


Gauvreau

APPENDIX 4

INDEX OF DRAWINGS

INDEX TO DRAWINGS

<u>Sheet No.</u>	<u>Title</u>
1	Project Map, Index
2	Site Plan, Range G & G-A
3	Demolition Plan
4	Grading Plan No. 1
5	Grading Plan No. 2
*6	Alignment & Control
*7	Profiles - Service Roads A, B & C
*8	Profiles - Service Roads D, E & F
*9	Profiles - Service Roads G, H, 1, 2 & 3
10	Profiles - Firing Line, Target Line 50M
*11	Profiles - Target Lines 75M, 100M
*12	Profiles - Target Lines 150M, 175M
*13	Profiles - Target Lines 200M, 250M, 300M
14	Sections & Details
*15	Landscaping Plan

H.N.D. STANDARD DRAWINGS

<u>Sheet No.</u>	<u>Title</u>
A-1	Control Tower - Plan & Elevations
A-2	Control Tower - Details
A-3	Omitted
A-4	Omitted
A-5	Standard Bldg. No. 2 - Plan & Elevations
A-6	Standard Bldg. No. 2 - Details
A-7	Latrine
A-8	Ammo. Breakdown Bldg.
A-9	Covered Mess - Plans & Sections
A-10	Omitted
**A-11	Bleacher Enclosure
C-1	Stationary Infantry Target Emplacement
C-2	Omitted
C-3	Miscellaneous Range Facilities
E-1	Range Power & Data Wiring Plan
E-2	Control Tower Electrical Plan
E-3	Control Tower Electrical Details
E-4	Miscellaneous Electrical Details
E-5	Cable Junction Box
E-6	Tower Junction Box
S-1	Control Tower Structural
S-2	Control Tower Structural Details

* Not included in concept package

** Drawing not available for concept package. Will be included in future submittals.

APPENDIX 5

DESIGN DIRECTIVE

1. ADDRESSEES

JOB SERIES: DES-85-MCA-FT DEVENS, MA-FORS (DR 13)

DATE: 26 JUN 85

FROM: CHIEF OF ENGR, ARMY BRANCH (ECC-A)

TO: CDR, NORTH ATLANTIC DIVISION (NADCO-CM)

INFORMATION:

CHIEF OF ENGR, ARMY BRANCH (ECC-A) PROG ANAL SEC
 CDR, US ARMY FORCES COMMAND (AFEN-TSC-M)
 CDR, HUNTSVILLE DIVISION (HNDED-PH)
 CDR, NEW YORK DISTRICT
 CDR, US ARMY SEVENTH SIGNAL COMMAND (CCN-PO-M)

3.001 PROJECT INFORMATION

DESIGN AGENT/CODE

CONST AGENT/CODE

MACOM/CODE

NEW YORK /NAN

NEW YORK /NAN

FORSCOM/20

PROJECT DESCR: MOD AUTO REC FIRE RNG

PROJECT TITLE

SCOPE/UM

CATEGORY

CONST STD

RNG

1/LS

17902

P

STATION NAME/CODE

FUND/CODE

PROJ NO

AUTH YR

PROG YR

FT DEVENS /25176

MMCA/11

189

89

89

AUTH DSN PHASE

PKGE PROG

PROGRAM AMOUNT

BAAN NO

2

AA

885000

APPROPRIATION CODE

PREVIOUS FNDS

FNDS THIS DIR

TOTAL FUNDS

3. REFERENCES

-
- A. FY 85 MCA DESIGN PROGRAM, APP 2, 4 JUN 85.
 - B. ANNOTATED DD FORM 1391, 24 JUN 85 (RESUBMITTAL), FY 89 MCA PN 189, FT DEVENS, MA (FN 3833).

4. DESCRIPTION OF AUTHORIZATION

ADDITIONAL DESIGN GUIDANCE FOR THE ABOVE PROJECT.

5. SPECIAL INSTRUCTIONS

-
- A. REF 38 IS FORWARDED BY THE 1391 PROCESSOR FOR CONCEPT DESIGN GUIDANCE.
 - B. REQUEST SUBMISSION OF ENG 3086 THROUGH DAEN-ECC-A TO DAEN-ECE-S WITHOUT DELAY.

ZELL L. MURPHY
CHIEF, EASTERN SECTION
CONSTR DIV, ARMY BRANCH
DIRECTORATE OF ENGINEERING & CONST

***** DD 1391 PROCESSOR (07/03/85) *****
 ** FOR OFFICIAL USE ONLY ** FORM 3833
 Massachusetts FY 1989 PROJNO - 018900
 FORT DEVENS
 2.A DATE 26 NOV 82
REVISION DATE - 24 JUL 85
 ASSUMED MIDPOINT OF CONSTRUCTION = 7/1989 COST INDEX = 1682

1. COMPONENT- ARMY
 2.A DATE 26 NOV 82
 2.B FISCAL YEAR - 1989
 2.C ESTIMATED START DATE: 4/1989
 COST INDEX: 1664
 ESTIMATED END DATE: 11/1989
 COST INDEX: 1706
 MIDPOINT OF CONSTRUCTION: 7/1989
 COST INDEX: 1682
 3.A INSTALLATION = FORT DEVENS
 SUBPOST OR REMOTE LOCATION = range
 3.B LOCATION = Massachusetts
 4.A PROJECT TITLE = Mod Automated Record Fire
 4.B TYPE OF WORK (NEW, ADDITION, ALTERATION, CONVERSION, MODERNIZATION,
 OR OTHER) TWO ENTRIES ALLOWED, SEPARATED BY A COMMA. = NEW
 6. CATEGORY CODE NUMBER - 179 89
 5. PROGRAM ELEMENT NUMBER =
 7. TEMPORARY PROJECT NUMBER = T400
 PERMANENT PROJECT NUMBER = 018900
 8. PROJECT COST (ROUNDED) = \$ 890,000

	U/M	QUANTITY	UNIT COST	COST(\$000)
9.A PRIMARY FACILITY (734)				
1) range bldg	SF	800	35.39	28
2) ammo issue bldg	SF	120	66.67	8
3) composting toilet-m/f	EA	1	29426.	29
4) control tower w/sc	SF	115	391.30	45
5) mess shed, covered	SF	800	35.39	28
6) lister bus shed	SF	100	35.39	4
7) heating oil tank	BL	22	45.21	1
8) flag pole	EA	1	1037.	1
9) PA Systems, posts & wiring	EA	1	15564.	16
10) RANGE LIGHTING	LS	1	30000.	31
11) FOXHOLES	EA	16	622.58	10
12) TARGET SYSTEM WIRING	M	24,600	13.15	323
13) TARGET EMPLACEMENT	EA	144	972.26	140
14) Range Road (Gravel)	SY	6,000	7.00	42
15) Covered Bleacher	SF	550	25.45	14
16) Gen. Maint/Park Area (6 Gravel)	SY	2,000	7.00	14

	U/M	QUANTITY	UNIT COST	COST(\$000)
9.B SUPPORTING FACILITIES (65)				
9.B1 ELECTRIC SERVICE (17)				
1)				
2) OH ELECTRIC LINES	LF	120	12.54	2
3) TRANSFORMER	KV	175	84.19	15

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9.B2 WATER, SEWER, & GAS ()

9.B3 STEAM AND/OR CHILLED WATER DISTRIBUTION ()

9.B4 PAVING WALKS, CURBS & GUTTERS ()

9.B5 STORM DRAINAGE ()

9.B6 SITE IMPROVEMENT/DEMOLITION (45)

1) DEMOLITION LS 1 10000. 11

2) SITE IMPROVEMENT LS 1 30000. 34

9.B7 COMMUNICATIONS (3)

1) COMMUNICATION LS 1 7000. 3

9.B8 OTHER ()

FACILITY SUBTOTAL 799

PER CENT OF SUPPORT COSTS TO PRIMARY COSTS 8.9%

9.C CONTINGENCY FACTOR = 5.00%

SUBTOTAL 799

CONTINGENCY AMOUNT 40

TOTAL CONTRACT COST 839

9.D S AND A PERCENT = 5.50%

TOTAL CONTRACT COST 839

SUPERVISION, INSPECTION, & OVERHEAD 46

TOTAL REQUEST 885

9.E INSTALLED EQUIPMENT - OTHER APPROPRIATIONS (\$000) 1,246

10.A TYPE OF CONSTRUCTION (PERMANENT/SEMI-PERMANENT/TEMPORARY) = PERM

10.B TYPE OF DESIGN

DOES THIS FACILITY INCLUDE UNUSUAL CONSTRUCTION FEATURES THAT REQUIRE
EXTRA DESIGN EFFORT? (YES/NO) = NO

DRAWING NO. = HNDM-1110-1-5

10.C DESIGN CAPACITY = 16 LANES ✓

10.D GROSS AREA = 5 AC

10.E COOLING (AIR COND, EVAP, OR MECH VENT)

MULTIPLE ENTRIES ALLOWED, SEPARATED BY COMMAS = AIR

CAPACITY (AIR COND) = 14,100 BTU

COST (AIR COND) = 1000

CAPACITY (EVAPORATIVE COOLING) =

COST (EVAPORATIVE COOLING) =

CAPACITY (MECHANICAL VENTILATION) =

COST (MECHANICAL VENTILATION) =

10.F DESCRIPTION OF WORK TO BE DONE

CONSTRUCT A PERMANENT, STANDARD-DESIGN, MODIFIED RECORD FIRE (MRF)
RIFLE MARKSMANSHIP RANGE CONSISTING OF 16 LANES AND RANGE SUPPORT
FACILITIES. THIS PROJECT WILL BE DESIGNED USING GUIDANCE
CONTAINED IN HNDM-1110-1-5 AND TC-25-2. RANGE SUPPORT FACILITIES
WILL INCLUDE A CONTROL TOWER, LATRINE (MALE/FEMALE), RANGE
PERSONNEL/STORAGE/MAINTENANCE BUILDING, AMMO-BREAKDOWN BUILDING,
COVERED BLEACHER, GENERAL MAINTENANCE AREA, COVERED MESS, LISTER
BAG HOLDER, AND PARKING AREA. EACH FIRING LANE WILL CONSIST OF A

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Handwritten:
HNDM-1110-1-5
TC-25-2

FOXHOLE AT THE FIRING LINE AND 9 STATIONARY PERSONNEL TARGET EMPLACEMENTS DOWN RANGE FROM THE FIRING LINE. EMPLACEMENT WORK WILL CONSIST OF EXCAVATION, DRAINAGE, FABRICATION AND INSTALLATION OF CONCRETE COFFIN, BERM CONSTRUCTION, AND JUNCTION BOX INSTALLATION. POWER AND DATA CABLES WILL BE INSTALLED FOR THE EMPLACEMENTS REQUIRED FOR A MRF AND TO SUPPORT POSSIBLE FUTURE MOVING TARGET EMPLACEMENTS. ONLY CABLES WILL BE INSTALLED AT FUTURE EMPLACEMENTS; NO OTHER WORK WILL BE DONE UNLESS NECESSITATED BY REVISION OF THE ARMY MARKSMANSHIP TRAINING PROGRAM. SPEAKER POSTS AND WIRING WILL BE INSTALLED FOR A PUBLIC ADDRESS SYSTEM. RANGE LIGHTING FOR CLEANUP AND EMERGENCIES WILL BE PROVIDED. REMOTE TARGET SYSTEM (KETS), TARGETS AND CONTROL EQUIPMENT WILL BE UTILIZED ON THIS RANGE. SITE IMPROVEMENTS INVOLVE ONLY MINOR EXCAVATION, FILL AND BORROW, AND LANDSCAPING. THIS RANGE WILL BE LOCATED ON AN EXISTING KNOWN-DISTANCE RIFLE RANGE. THE PRESENT SINGLE ROW OF MANUALLY OPERATED TARGET MECHANISMS WILL REMAIN IN PLACE AND WILL CONTINUE TO BE USABLE. FUTURE TARGETS COULD BE INCORPORATED AT DISTANCES UP TO 550 METERS WITHOUT ALTERING THE MRF OR DOING ADDITIONAL CLEARING OR LANDSCAPING. THE RANGE ROAD WILL BE REROUTED BY UPGRADING EXISTING TRAILS. TWO LATRINES WITH A TOTAL AREA OF 440 SQ. FEET AND TWO SMALL OPEN COVERED STRUCTURES WILL BE DEMOLISHED. THIS PROJECT WILL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH CURRENT ENERGY CONSERVATION POLICIES AND REGULATIONS. INSULATION WILL CONFORM TO DOD MANUAL 4270.1-M. THIS RANGE IS NOT SITED IN A FLOOD PLAIN. ACCESSIBILITY FOR THE HANDICAPPED IS NOT PROVIDED FOR FUNCTIONAL REASONS. Heating and air conditioning with self-contained systems.

*air conditioning (control tower): 2 tons.

Target Count: ITM 144.

11. QUANTITATIVE DATA

11.A	U/M - EA	
11.B	TOTAL REQUIREMENT	= 1
11.C	EXISTING SUBSTANDARD=	
11.D	EXISTING ADEQUATE	= 0
11.E	FUNDED, NOT IN INVENTORY=	0
11.F	ADEQUATE ASSETS (D+E)	= 0
11.G	UNFUNDED PRIOR AUTHORIZATION=	
11.H	INCLUDED IN PRIOR YEAR PROGRAM	
	FISCAL YEAR = 0	
	AUTHORIZED =	
	FUNDED =	
11.I	DEFICIENCY (B-F-G-H)	
	AUTHORIZED =	1
	FUNDED =	1

11.J REMARKS

11.K RELATED PROJECTS

11.L PROJECT (WHAT IS NEEDED)

construct modified record fire range at fort devens, ma.

11.M REQUIREMENT (WHY IS IT NEEDED NOW)

THIS PROJECT IS REQUIRED TO PROVIDE MARKSMANSHIP TRAINING FOR THE APPROXIMATELY 3,000 ACTIVE COMPONENT PERSONNEL AT FORT DEVENS AND 50,000 RESERVE COMPONENT PERSONNEL SUPPORTED BY FORT DEVENS, THE ONLY ACTIVE ARMY INSTALLATION IN THE SIX NEW ENGLAND

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STATES. THE MODIFIED RECORD FIRE RANGE UTILIZING KETS
WILL PROVIDE A REALISTIC FACILITY TO IMPROVE SOLDIERS COMBAT
READINESS AND TO EVALUATE THE INDIVIDUAL SOLDIER'S ABILITY
TO EFFECTIVELY ENGAGE MULTIPLE TARGETS IN A TIME CONSTRAINED
TRAINING ENVIRONMENT. TRAINING AND EVALUATION USING THIS
RANGE WILL SUPPORT THE ARMY'S RIFLE MARKSMANSHIP TRAINING PROGRAM.

11.N CURRENT SITUATION (HOW IS THE NEED CURRENTLY BEING MET)
BASIC RIFLE MARKSMANSHIP TRAINING IS BEING CONDUCTED ON
INADEQUATE, OBSOLETE RECORD FIRE RANGES UTILIZING WORLD WAR II
TRAINING METHODOLOGY. THE CURRENT SYSTEM IS RESOURCE
INTENSIVE, REQUIRING A SCORER FOR EACH FIKER TO MANUALLY COUNT
THE TARGET HITS. THE EXISTING RANGE IS LOCATED NEAR THE
INSTALLATION BOUNDARY, EXPOSING THE TARGETS TO VANDALISM AND
INCREASING THE NOISE TO THE NEARBY COMMUNITY.

11.O IMPACT IF NOT PROVIDED
IF THIS PROJECT IS NOT APPROVED, INADEQUATE AND ANTIQUATED
RECORD FIRE RANGES MUST CONTINUE TO BE UTILIZED, RESULTING
IN A SIGNIFICANT LOSS OF TRAINING TIME, LOWER QUALITY TRAINING,
AND EXTENSIVE MAINTENANCE.
USE OF INEFFICIENT MANUALLY SCORED RANGES WILL CONTINUE TO REDUCE
THE SOLDIER'S ABILITY TO FIGHT A BETTER TRAINED ENEMY.

11.R NATO INFRASTRUCTURE

11.P ADDITIONAL

11.Q SIGNATURE BLOCK
PLEASE ENTER NAME = EDWARD W. NEWELL
PLEASE ENTER RANK = COLONEL, ARMOR
PLEASE ENTER TITLE = INSTALLATION COMMANDER
DO YOU WISH THE BLOCK TO BE SIGNED (YES/NO)? = YES

S SUPPLEMENTAL DATA

SA. ESTIMATED ANNUAL COST TO OPERATE PROPOSED FACILITY (\$000) =
WATER SERVICE (GALLONS/YEAR, IN THOUSANDS) =
ELECTRIC SERVICE (MEGAWATT HOURS/YEAR) =
HEATING SERVICE (MILLION BTU/YEAR) =
SB. NUMBER OF ADDITIONAL FUNCTIONAL OPERATIONAL PERSONNEL = /11P
SC. ESTIMATED LIFE-CYCLE COST TO OPERATE AND MAINTAIN THE
PROPOSED FACILITY =
SD. ESTIMATED LIFE-CYCLE COST TO OPERATE AND MAINTAIN THE
EXISTING FACILITY IF NEW FACILITY IS A REPLACEMENT =
UTILITIES SERVICE DIFFERENT FROM NEW FACILITY (Y/N) =
WATER SERVICE (GALLONS/YEAR, IN THOUSANDS) =
ELECTRIC SERVICE (MEGAWATT/YEAR) =
HEATING SERVICE (MILLION BTU/YEAR) =
ADDITIONAL CAPACITY OR RENOVATION (Y/N) =
DESIGN COST, ADDITION OR RENOVATION (\$000) =
PROJECT COST, ADDITION OR RENOVATION =
EQUIP COST, OTHER AFFNS, ADDITION, OR RENOVATION =
RENOVATION ECONOMIC LIFE LESS THAN 25 YEARS (Y/N) =
RENOVATION ECONOMIC LIFE (YEARS) =
SE. PLANNING AND DESIGN DATA (ESTIMATED)
SE.1A DESIGN START DATE, ESTIMATED (MM YY) =
SE.1B PERCENT COMPLETE AS OF JANUARY 15, =
SE.1C PERCENT COMPLETE AS OF OCTOBER 1, =
SE.1D DESIGN COMPLETION DATE, ESTIMATED (MM YY) =
SE.2a STANDARD OR DEFINITIVE DESIGN (Y/N) =

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SE.2B POST WIRE DESIGN WAS LAST USED -
 SE.3A PRODUCTION OF PLANS AND SPEC'S (\$000) -
 SE.3B ALL OTHER DESIGN COSTS (\$000) -
 SE.3C TOTAL COST (C) = (A)+(B) OR (D)+(E)(\$000) -
 SE.3D CONTRACT ARCHITECT-ENGINEER DESIGN COST,
 ESTIMATED (\$000) =
 SE.3E IN-HOUSE DESIGN COST PLUS ARCHITECT-ENGINEER CONTRACT
 SUPERVISION AND ADMINISTRATION COST GOVERNMENT FORCES
 DESIGN COST, ESTIMATED (\$000) =
 SE.4 CONSTRUCTION START DATE (MMM YY) -
 SF. EQUIPMENT FUNDED FROM APPROPRIATIONS OTHER THAN MCA AND OMA,
 (: NONENCLOSURE : PROCURING AGENCY : AGENCY FY : COST (\$000))

D1. GENERAL:

THIS PROJECT IS REQUIRED TO PROVIDE TRAINING RANGE FACILITIES
 TO ACCOMMODATE RETS (REMOVED TARGET SYSTEM), A SYSTEM
 DESIGNED TO REPLACE SMALL ARMS PERSONNEL TARGET SYSTEMS CURRENTLY
 IN USE THROUGHOUT THE ARMY. RETS EQUIPMENT CONSISTS OF TARGET
 MECHANISMS, TARGET SILHOUETTES, COMMUNICATION LINKS, AND A
 COMPUTER CONTROLLED CONSOLE WHICH COMMANDS DOWNRANGE EQUIPMENT
 AUTOMATICALLY, PROVIDES STATUS OF RANGE EQUIPMENT, AND PRODUCES
 A HARD COPY OF THE INDIVIDUAL SOLDIER'S SCORE. RETS EVALUATES
 THE SOLDIER'S ABILITY TO ENGAGE SINGLE AND MULTIPLE TARGETS IN A
 TIME CONSTRAINED TRAINING ENVIRONMENT. DIGITAL PROCESSING
 FLEXIBILITY IN RETS ALLOWS EASY UPDATE OF PROGRAMS TO REMAIN
 CURRENT WITH REVISED TRAINING PROGRAMS. RETS IS CURRENTLY
 STATE-OF-THE-ART IN COMBAT MARKSMANSHIP TRAINING AND
 TRAINING REALISM. THE RETS MRF (MODIFIED RECORD FIRE) RANGE,
 WHICH HAS BEEN TYPE CLASSIFIED, WILL REPLACE THE CURRENT RECORD
 FIRE RANGE (TRAINFIRE) AND WILL BECOME THE STANDARD FOR RIFLE
 MARKSMANSHIP QUALIFICATION. THE MRF IS DESIGNED FOR POSTS WITH
 LIMITED TRAINING AREA OR MODERATE LEVELS OF USAGE AS IT SUPPORTS
 FIELD FIRE AND QUALIFICATION. TO ATTAIN SOLDIER
 PROFICIENCY WITH MODERN WEAPON SYSTEMS REQUIRES RANGES WITH
 MAXIMUM TRAINING REALISM.

D2. ACCOMMODATIONS NOW IN USE:

CURRENT TRAINING AND QUALIFICATION ARE CONDUCTED ON E RANGE, SOUTH
 POST FORT DEVENS, A 16 LANE TRAINFIRE RANGE.

NO. OF LANES	TYPE TARGET	DISTANCE	TARGET MECHANISM
16	E-SILHOUETTE	50-300 M.	ELECTRICAL POP-UP

D3. ANALYSIS OF DEFICIENCY:

WEAPONS TRAINING IS CURRENTLY BEING CONDUCTED ON INADEQUATE,
 OUTDATED RANGE SYSTEMS AND FACILITIES DESIGNED FOR WWII TRAINING
 METHODOLOGY. THE CURRENT SYSTEM IS TIME CONSUMING,
 INEFFICIENT AND RESOURCE INTENSIVE. EFFICIENT TRAINING EFFORTS
 ARE HAMPERED BY INACCURATE MANUAL SCORING SYSTEMS. MODERN
 TRAINING RANGE FACILITIES TO INCORPORATING RETS COMPONENTS WILL
 SIGNIFICANTLY COMPLEMENT AND REINFORCE MILITARY TRAINING
 OBJECTIVES TO ACHIEVE READINESS. THE SOPHISTICATION OF MODERN
 WEAPONRY COMMANDS IMMEDIATE ATTENTION TO PROVIDING MODERN RANGE
 FACILITIES TO ACCOMMODATE RETS EQUIPMENT. THE CURRENT FIRING

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RANGE IS ORIENTED SO THE MAXIMUM RANGES OF THE WEAPONS FIRED, EXCEED THE DISTANCE ACROSS THE IMPACT AREA AT THAT LOCATION. THE MAXIMUM RANGE OF AN M14 FIRING 5.56MM IS 2453 METERS AND THE DISTANCE TO THE FAR SIDE OF THE IMPACT AREA AT THE CURRENT FIRING ORIENTATION IS APPROXIMATELY 1850 METERS. THE EXISTING RANGE IS LOCATED ONLY 250 METERS FROM THE INSTALLATION BOUNDARY, CAUSING NOISE FOR THE NEARBY COMMUNITY AND EXPOSING THE TARGET SYSTEMS AND RANGE FACILITIES TO VANDALISM.

D4. CONSIDERATION OF ALTERNATIVES:
PROJECT 1400 HAS BEEN DETERMINED TO BE THE ARMY AND GOVERNMENT'S MOST ADVANTAGEOUS METHOD TO PROVIDE RIFLE MARKSMANSHIP TRAINING AND QUALIFICATION OF ALL THE ALTERNATIVES CONSIDERED. THIS OPTION REQUIRES NO LOSS OF MANUEVER AREA OR RANGE SPACE, HAS THE DIRECTION OF FIRE ORIENTED ON THE LONGEST AXIS OF THE IMPACT AREA, HAS LOW COST LANDSCAPING, AND WILL REDUCE TROOP TRANSPORTATION TIME AS IT IS THE CLOSEST RANGE TO THE TRAINING AREA ENTRANCE.

OFF-POST FACILITIES. THERE ARE NO OFF-POST RANGES WHICH WILL SUPPORT MILITARY MARKSMANSHIP QUALIFICATION.

UPGRADE PRESENT FACILITIES. THE PRESENT M-14 RANGE IS E RANGE. THE COST TO UPGRADE E RANGE IS EQUIVALENT TO THE COST TO CONSTRUCT THE RANGE ON THE PROPOSED LOCATION. E RANGE IS SITUATED SO THE MAXIMUM RANGE OF THE RIFLE ROUND EXCEEDS THE DEPTH OF THE IMPACT AREA OF THAT POINT. E RANGE IS CLOSER TO THE INSTALLATION BOUNDARY AND NEARBY RESIDENTIAL AREAS, THEREFORE CAUSING MORE NOISE DISTURBANCE THAN THE PROPOSED RANGE. THERE IS SWAMP BEYOND THE 300 METER LINE ON E RANGE SO ADDING FUTURE TARGETS AT GREATER RANGES TO ACCOMMODATE NEW WEAPONS SYSTEMS WOULD NOT BE POSSIBLE. FIVE LANES OF E RANGE WILL BE ELIMINATED BY THE CONSTRUCTION OF A M-60/SAW RANGE, FY 88 MCA PROJECT T-423.

MODIFY OTHER ON-POST FACILITIES. NO OTHER LOCATION ON POST HAS AS MUCH IMPACT AREA DOWNRANGE AS THE PROPOSED SITE. BECAUSE OF SWAMPS OR RAPID CHANGES IN ELEVATION NO POSSIBLE SITE COULD ACCOMMODATE TARGETS AT GREATER RANGES IF THAT BECAME DESIRABLE IN THE FUTURE. USE OF ANY OTHER SITE WHICH DID NOT REQUIRE EXTENSIVE CLEARING AND LANDSCAPING WOULD REQUIRE CLOSING RANGES WHICH ARE NEEDED FOR TRAINING.

USE OF RETS RANGES AT OTHER MILITARY POSTS, EVEN ASSUMING THOSE RANGES WERE SUFFICIENTLY AVAILABLE AFTER MEETING THE REQUIREMENTS OF RESIDENT UNITS, THIS IS NOT AN ECONOMICAL ALTERNATIVE. PARAGRAPH II INCLUDES A DETAILED ANALYSIS OF THE OPTION OF CONDUCTING THIS FIRING AT FORT DRUM. THIS ANALYSIS DEMONSTRATES THAT A VERY CONSERVATIVE ESTIMATE OF THE ADDITIONAL MARGINAL COST TO THE ARMY FOR A SINGLE YEAR IS \$1,050,000, THIS EXCEEDS THE TOTAL CONSTRUCTION COST OF THE MRF RANGE AT FORT DEVENS. NO RETS RIFLE MARKSMANSHIP RANGE IS PROGRAMMED FOR CAMP EDWARDS.

D5. CRITERIA FOR PROPOSED CONSTRUCTION:
FACILITY CRITERIA FOR RANGE TRAINING FACILITIES IS IN DOD 4270.1-M, CONSTRUCTION CRITERIA, AND TC 25-2, TRAINING RANGES. DESIGN WILL BE IN ACCORDANCE WITH THE STANDARD DESIGN FOR A MRF IN HNDM 1110-1-5, DESIGN INFORMATION FOR INFANTRY RIFLE MARKSMANSHIP

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RANGES.

D6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT:
THE TARGETRY MECHANISMS AND COMPUTER CONSOLE ARE OPA FUNDED.

D7. DISPOSAL OF PRESENT ASSETS:
STRUCTURES 4214 AND 4253 ARE COVERED AREAS WITHOUT WALLS WHICH
MUST BE REMOVED AS THEY WOULD BE BETWEEN THE FIRING LINE AND
THE TARGETS. THE LATRINES ARE NOT LARGE ENOUGH FOR THE USAGE
LEVEL OF THE NEW RANGE AND THEY ARE REACHING THE END OF THEIR
USEFUL LIFE.

BLDG NO	TYPE CONST	BLDG FUNCTION	GROSS SQ FT
4214	T	FIELD LATRINE	224
4240	T	FIELD LATRINE	224
4252	T	AMMO ISSUE PT	1 EACH
4253	T	LISTER BAG HLDR	1 EACH

D8. SURVIVAL MEASURES:
THIS PROJECT IS NOT SUITABLE FOR INCLUSION OF PROTECTIVE
SHELTER.

D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:
THE RECORD OF ENVIRONMENTAL CONSIDERATION (AR 200-2, PARA 2-2B)
IS INCLUDED IN SRP-4. IT HAS BEEN DETERMINED THAT THE ACTION
IS ADEQUATELY COVERED IN THE EXISTING EIS ENTITLED ON GOING
MISSION ACTIVITIES, DATED 1 MAY 1980, AND QUALIFIES FOR
CATEGORICAL EXCLUSION NO. 28.

D10. EVALUATION OF FLOOD HAZARDS:
THE PROPOSED PROJECT IS NOT LOCATED IN A FLOODPLAIN AND DOES
NOT ENROACH ON WETLANDS.

D11. ECONOMIC JUSTIFICATION:
THE ONLY ALTERNATIVE DISCUSSED IN PARAGRAPH 4, CONSIDERATION OF
ALTERNATIVES, WHICH ACCOMPLISHED THE REQUIREMENT AND WAS AMENABLE
TO ECONOMIC ANALYSIS IS THE OPTION OF CONDUCTING THE FIRING AT
OF ANOTHER MILITARY INSTALLATION, FORT DRUM, NY. USING
CONSERVATIVE ESTIMATES OF ALL COSTS AND FACTORS, UTILIZING FORT
DRUM FOR QUALIFICATION IS CLEARLY NOT ECONOMICALLY FEASIBLE. THE
ANALYSIS FOLLOWS:

TOTAL NUMBER OF M16 FIRERS	
10TH SFG-750 FIRERS QU. 2 X EACH YEAR	1,500
OTHER ACTIVE ON FORT DEVENS	1,800
RESERVE COMPONENT WHO FIRED AT DEVENS FY84	9,737
FIRERS	13,000

ASSUMING THAT EACH GROUP OF 40 SOLDIERS INCLUDES A RANK
DISTRIBUTION OF 35 E-5, 4 E-6, AND 1 EACH O-2. (THE ACTUAL
AVERAGE RANK DISTRIBUTION IS PROBABLY HIGHER, MEANING THIS IS
THE LOWER LIMIT ON POSSIBLE COSTS.)

MARGINAL COST OF SOLDIERS' TIME

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GRADE	NUMBER	VALUE OF ONE DAY	COST
E-3	11,325	\$ 72	\$819,000
E-4	1,300	\$115	\$149,500
O-2	325	\$153	\$ 49,725

COST \$1,018,225

TBY COST

PER DAY COST	ACTIVE DUTY SOLDIERS	COST
\$4	3300	\$13,200

TRANSPORTATION COST

THE MOST EFFICIENT MILITARY BUSES AVAILABLE ON FORT DEVENS COST 10 CENTS PER MILE TO OPERATE. THE OLDER BUSES ARE MORE THAN 10 TIMES AS EXPENSIVE TO OPERATE. COMMERCIAL BUSES ARE APPROXIMATELY \$250 ROUND TRIP. IT IS NOT LIKELY THAT SUFFICIENT QUANTITIES OF EFFICIENT MILITARY BUSES WOULD ALWAYS BE AVAILABLE AS THEY HAVE MANY OTHER COMMITMENTS. BUT TO BE CONSERVATIVE IT WILL BE ASSUMED THAT THERE ARE ALWAYS SUFFICIENT EFFICIENT MILITARY BUSES AVAILABLE TO MEET THE REQUIREMENT. AT A PEAK CAPACITY OF 40 PERSONNEL (THE 44 PASSENGER BUSES WOULD BE CARRYING 40 PEOPLE PLUS ALL THE WEAPONS AND EQUIPMENT). IT WOULD TAKE 325 BUS LOADS TO MOVE ALL 13,000 PERSONNEL TO FORT DRUM.

NO OF TRIPS	MILES TO DRUM	ROUND TRIP	COST PER MILE	COST
325	315	630	\$.10	\$20,475

TOTAL ANNUAL MARGINAL COST OF FIRING AT FORT DRUM

VALUE OF SOLDIERS TIME	\$1,018,225
TBY COST	13,200
TRANSPORTATION COST	20,475
	\$1,051,900

ALTHOUGH IT SEEMS HIGH THIS ESTIMATE OF COSTS IS LOWER THAN THAT WHICH WOULD ACTUALLY BE EXPERIENCED BECAUSE IT DOES NOT INCLUDE: NON-FIRERS WHO WILL HAVE TO GO TO FORT DRUM TO SUPPORT THE FIRING (SAFETY OFFICER, AMMO NCO'S ETC); THE COST OF SENDING AN ADVANCE PARTY; OR THE EXTRA FIRERS WHO WILL NEED TO QUALIFY BECAUSE OF PERSONNEL TURNOVER. IN ADDITION THERE ARE FACTORS OF A LOSS OF TRAINING FLEXIBILITY BECAUSE OF THE ADDITIONAL COMPLICATIONS FOR A UNIT TO SCHEDULE A RANGE AND THE LOSS OF SOLDIER MORALE FROM WASTING TIME ON LONG BUS RIDES FOR LIMITED TRAINING TIME. THERE ARE ADDITIONAL CONSTRAINTS IN SCHEDULING BECAUSE THE RANGES AT FORT DRUM WILL BE HEAVILY UTILIZED BY UNITS STATIONED AT FORT DRUM. THIS ANALYSIS HAS ASSUMED THESE RANGES WOULD ALWAYS BE AVAILABLE.

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AS THIS ANNUAL COST EXCEEDS THE ONE TIME COST OF BUILDING A MRF RANGE AT FORT DEVENS THE LIFE CYCLE COST OF THE FORT DRUM ALTERNATIVE WILL BE MANY TIMES LARGER THAN THE COST OF THE PROPOSED PROJECT.

D12. UTILITY AND COMMUNICATIONS SUPPORT:

A. UTILITIES SUPPORT: FY85 MINOR MCA PROJECT PERMANENT NUMBER 202E, RANGE DISTRIBUTION LINES, WILL SUPPLY THE ELECTRICAL SUPPORT FOR THIS AND OTHER RANGES. NO OTHER RELATED UTILITIES SUPPORT PROJECTS ARE PROGRAMMED.

B. TELECOMMUNICATIONS: COMMUNICATIONS SUPPORT WILL CONSIST OF TELEPHONE SYSTEM (FIELD AND COMMERCIAL TERMINALS), RADIO TELEPHONE SYSTEM FM AND AM PORTABLE, PUBLIC ADDRESS SYSTEMS, AND INTERCOM SYSTEM CONNECTED THROUGH OVERHEAD AND UNDERGROUND TO RANGE FACILITIES. ESTIMATED COST \$3000.

SIGNED

ROBERT MCMASTER
DIRECTOR
USACC-FORT DEVENS

D13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES: THIS PROJECT HAS BEEN REVIEWED FOR IMPACT ON HISTORIC AND ARCHAEOLOGICAL PROPERTY AND COMPLIES WITH THE INTENT OF PL 89-665, AS AMENDED, AND EXECUTIVE ORDER 11593.

D14. PROJECT DEVELOPMENT BROCHURE:
PROJECT SUMMARY (PS) AND PROJECT DEVELOPMENT BROCHURE (PDB) FOR THIS PROJECT WERE PREPARED 1 OCT 84.

D15. ENERGY REQUIREMENTS:

A. PROJECT DESCRIPTION: CONSTRUCT RANGE FACILITIES TO ACCOMMODATE RETS (MRF) MARKSMANSHIP RANGE AT FORT DEVENS.

B. ESTIMATED ENERGY CONSUMPTION:

1. HEATING SYSTEM: SELF CONTAINED NO. 2 OIL FIRED HEATING PLANT.

A. NO. 2 FUEL OIL:

1892 SF X 40 BTU/SF/HR = 75.7 MBH/HR
(75,680 BTU/HR X 6800 DEGREE DAYS X 24) 165
= 190,015 MBH/YR
140,000 BTU/GA AT 80% EFF = 112,000 BTU/GA
(190,015 MBH/YR) (112 MBH/GA)
= 1,697 GA/YR

2. AIR CONDITIONING SYSTEM:

100 SF X 141 BTU/HR/SF = 14,100 BTU/HR
(14100 BTU/HR) X (3.413 W HRS/BTU) X (120 DAYS/YR) X (12 HRS/DAY)
= 69,257,552 W-HRS/YR

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3. WATER SUPPLY: POTABLE WATER WILL BE SUPPLIED BY LISTER BAG TO RANGE AREA.
4. ELECTRICAL POWER: ELECTRICAL SERVICE WILL PROVIDE POWER FOR EQUIPMENT, LIGHTING AND HEATING; BOTH 110, 220 ALTERNATING CURRENT, AND 24 TO 28 VOLTS OF DIRECT CURRENT ARE AVAILABLE WHERE REQUIRED.
5. SEWERAGE SYSTEM: NO SEWER FACILITIES AVAILABLE; COMPOSTING TOILET WILL PROVIDE LATRINE SERVICE.
- C. ENERGY SOURCES:

1. HEATING: HEAT FOR PRIMARY FACILITY WILL BE SUPPLIED FROM SELF CONTAINED NO. 2 FUEL OIL FIRED BOILER.
2. ELECTRICAL POWER: THERE IS EXISTING POWER TO G RANGE.
3. WATER SUPPLY: WATER IS SUPPLIED BY LISTER BAG TO RANGE AREA.
4. AIR CONDITIONING: SELF CONTAINED (PROVIDED FOR CONTROL TOWER CONSOLE EQUIPMENT).
- D. ENERGY USE IMPACTS: NO ADDITIONAL ENERGY IMPACTS BEYOND EXISTING RANGE REQUIREMENTS FOR FUEL, UTILITIES AND COMMUNICATIONS ARE IMPOSED BY PROPOSED PROJECT.
- E. ENERGY CONSERVATION: THIS PROJECT WILL BE DESIGNED AND CONSTRUCTED IAW CURRENT ENERGY CONSERVATION POLICIES AND REGULATIONS.
- F. ENERGY ALTERNATIVES: THERE ARE NO ALTERNATIVE MEANS TO SUPPLY THE ENERGY REQUIREMENTS.
- G. ENERGY EFFECTS: NO ADVERSE ENVIRONMENTAL EFFECTS ARE ANTICIPATED FROM DEVELOPMENT OF THE ENERGY SYSTEMS.
- H. BASIS OF APPRAISAL: SELECTIVE ENERGY IS APPROPRIATE FOR THIS PROJECT BECAUSE OF LIMITED SCOPE.

D16. PROVISIONS FOR THE HANDICAPPED:
THE HANDICAPPED WILL NOT BE PROVIDED FOR IN THIS PROJECT SINCE THE FACILITY WILL BE USED AND OPERATED SOLELY BY ABLE-BODIED MILITARY PERSONNEL.

D17. REAL PROPERTY MAINTENANCE ACTIVITY (RPMA) ANALYSIS

A. PHYSICAL IMPACT:

UNITS	ADDED	REMOVED	NET CHANGE
LANES	16	0	+16
SF	2,148	448	+1700
SY	6,000	4,000	+2000

B. OPERATION AND MAINTENANCE IMPACT:

YEAR	NEW (\$M)
1988(BUD)	2,501
1989	2,694
1990	2,901

D18. COMMERCIAL ACTIVITIES (CA) ANALYSIS:

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THIS IS NOT A NEW START AS DEFINED IN DA CIRCULAR 235-1, SECTION 3-15, PARA D, AS THIS PROJECT IS PROGRAMMED TO PROVIDE A MODERN TRAINING RANGE (MODIFIED RECORD FIRE) TO ENABLE OPTIMUM TRAINING PROFICIENCY AND READINESS FOR WARTIME MISSIONS.

SR1

SR2

SR3

A. PROJECT DESCRIPTION: CONSTRUCT RANGE FACILITIES TO ACCOMMODATE 1KETS (DTR) TRAINING RANGE AT FORT DEVENS.

B. ESTIMATED ENERGY CONSUMPTION:

1. HEATING SYSTEM: SELF CONTAINED NO. 2 FUEL OIL FIRED HEATING PLANT

A. NO. 2 FUEL OIL:

1892SF X 40BTU/SF/HR=	75.7 MBH/HR
(75,680BTU/HR X 4800DEG DAYS X 24)/65=	190,015 MBH/YR
140,000BTU/GA AT 80% EFF=	112,000BTU/GA
190,015MBH/YR/112MBH/GA=	1,697 GA/YR

2. AIR CONDITIONING SYSTEM:

100 SF= X 141 BTU/HR PER SF 14,100 BTU/HR

14,100BTU/HR X 3.413W-HRS X 120 DA X 12 HRS= 69,298 KW-HRS
BTU YR DA YR

3. WATER SUPPLY: POTABLE WATER WILL BE SUPPLIED BY LISTER BAG TO RANGE AREA TO ACCOMMODATE PROPOSED PROJECT.

4. ELECTRICAL POWER: ELECTRICAL SERVICE WILL PROVIDE POWER FOR EQUIPMENT, LIGHTING AND HEATING; BOTH 110, 220 ALTERNATING CURRENT, AND 24 TO 28 VOLTS OF DIRECT CURRENT ARE AVAILABLE WHERE REQUIRED.

5. SEWERAGE SYSTEM: NO SEWER FACILITIES AVAILABLE; COMPOSTING TOILET WILL BE PROVIDED FOR LATRINE SERVICE.

C. ENERGY SOURCES:

1. HEATING: HEAT FOR PRIMARY FACILITY WILL BE SUPPLIED FROM SELF CONTAINED NO. 2 FUEL OIL FIRED BOILER.

2. ELECTRICAL POWER: THERE IS EXISTING POWER TO RANGES.

3. WATER SUPPLY: WATER IS SUPPLIED BY LISTER BAG TO RANGE AREA.

4. AIR CONDITIONING: SELF CONTAINED (PROVIDED FOR CONTROL TOWER CONSOLE EQUIPMENT).

D. ENERGY USE IMPACTS: NO ADDITIONAL ENERGY IMPACTS BEYOND EXISTING RANGE REQUIREMENTS FOR FUEL, UTILITIES AND COMMUNICATIONS ARE

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IMPOSED BY PROPOSED PROJECT.

E. ENERGY CONSERVATION: THIS PROJECT WILL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH CURRENT ENERGY CONSERVATION POLICIES AND REGULATIONS.

F. ENERGY ALTERNATIVES: N/A.

G. ENERGY EFFECTS: NO ADVERSE ENVIRONMENTAL EFFECTS ARE ANTICIPATED FROM DEVELOPMENT OF THE ENERGY SYSTEMS DESCRIBED PREVIOUSLY.

H. BASIS OF APPRAISAL: SELECTIVE ENERGY IS APPROPRIATE FOR THIS PROJECT BECAUSE OF LIMITED SCOPE.

SR4

SR5

SR6

SR7

SR8

SR9

Z1*

DATE:06/11/85
TIME:10:27:43

BY: ECES

A COPY OF THE FORM FOLLOWS.

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REVISION DATE: 28 MAY 85

44 OF 06/11/85 AT 10:27:22) 28 NOV 82

LAF= 1.06

FORT DEVENS--range
Massachusetts

MODIFIED RECORD FIRE

179 89

018900

978

PRIMARY FACILITY

range bldg

ammo issue bldg

composting toilet-w/f

control tower w/ ac

mess shed

Total from Continuation Page

SUPPORT FACILITIES

Electric Service

Site Serv (44) (15)

Communication

SF	800	34.11(22)
SF	120	34.11(4)
EA	1	28359.(28)
SF	100	116.10(12)
SF	800	34.11(27)
		(717)
LS	--	-- (62
LS	--	-- (15)
LS	--	-- (44)
			3)

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